

Aviation Week

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August 7, 1961

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Grain
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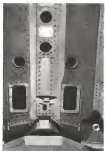


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Grumman A-1 JAGHAW



Grumman A-1 JAGHAW

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C.—National Press Bldg., Phone: 635-6001; Radio City Station, 1st Floor, Room 1000, 1230 Ave. of the Americas, New York 10020; 2-1230 (Days 2-4, 7-10); 2-1231 (Days 5-6); 2-1232 (Days 7-10); 2-1233 (Days 2-4, 7-10); 2-1234 (Days 5-6); 2-1235 (Days 7-10); 2-1236 (Days 2-4, 7-10); 2-1237 (Days 5-6); 2-1238 (Days 7-10); 2-1239 (Days 2-4, 7-10); 2-1240 (Days 5-6); 2-1241 (Days 7-10); 2-1242 (Days 2-4, 7-10); 2-1243 (Days 5-6); 2-1244 (Days 7-10); 2-1245 (Days 2-4, 7-10); 2-1246 (Days 5-6); 2-1247 (Days 7-10); 2-1248 (Days 2-4, 7-10); 2-1249 (Days 5-6); 2-1250 (Days 7-10); 2-1251 (Days 2-4, 7-10); 2-1252 (Days 5-6); 2-1253 (Days 7-10); 2-1254 (Days 2-4, 7-10); 2-1255 (Days 5-6); 2-1256 (Days 7-10); 2-1257 (Days 2-4, 7-10); 2-1258 (Days 5-6); 2-1259 (Days 7-10); 2-1260 (Days 2-4, 7-10); 2-1261 (Days 5-6); 2-1262 (Days 7-10); 2-1263 (Days 2-4, 7-10); 2-1264 (Days 5-6); 2-1265 (Days 7-10); 2-1266 (Days 2-4, 7-10); 2-1267 (Days 5-6); 2-1268 (Days 7-10); 2-1269 (Days 2-4, 7-10); 2-1270 (Days 5-6); 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THE U.S. NAVY'S Polaris Platoon System

When a Polaris sub reaches port, there's a new crew waiting to take her out again. For America's missile submarines, even one day is too long.

This process involves keeping each sub and her 35 Polaris missiles on station continuously.

The deterrent power of Polaris grows steadily stronger—as longer-range missiles are perfected, and as more Polaris subs are commissioned.

Located in Polaris missile prime contractors, system manager, major subcontractors, Aerospace General, General Electric, Westinghouse.

LOCKHEED

MILWAUKEE & SPACE DIVISION, BURLINGAME, CALIF.

EDITORIAL

Defensive Problems

The problem of using effective military weapons offers a wide choice of possibilities that can be tailored in many instances to suit the varying national policies and purposes of the countries concerned.

For example, the fact that the Soviets are building a second generation of response long-range bombers does not necessarily mean that the best U.S. policy lies in pursuing a similar course. It may be prudent to continue to bolster B-52 and B-58 strength for the indefinite future to ensure that there is no possibility of a deterrent gap before large numbers of solid-fueled missiles can take over the major portion of that role. But it is becoming increasingly obvious that the development of the Mach 3 B-70 bomber offers only marginal possibilities for major military advantage for the time passed into which it has now slipped.

Although the Air Force is clinging to the B-70 project with confused fervor, many people are raising the question whether the substantial funding now being poured into the B-70 program could not be invested with more profit to the defense posture in some other, considerably more advanced methods of waging long-range offensive warfare. This is a debate that is likely to grow in intensity as the inexorable technical logic of this situation backs the Westward crusades into a tight corner.

When it comes to the problem of defense, however, there is no choice available except to counter the enemy's weapons. The kind of defense that this country holds out of necessity determined by the kind of weapons the Soviets develop to wage offensive warfare. Among the prime requisites in building adequate defensive forces is certainly to limit the enemy's offensive capability; of today are accurate intelligence and intelligent foresight. It is almost too late to research, develop, produce and deploy a defensive system if you wait until the enemy reveals his new offensive equipment, even its prototype form.

Thus, it is obvious that we should have been working on a defensive system against Soviet ICBMs even before we got the first intelligence confirmation that they had indeed embarked on the development of this type of weapons. Unfortunately, our ICBM defense effort has been confined to the single channel of the Nike Zeus approach, plus a rather thinly funded broad research study sponsored by ARPA. It is impossible to determine at this point in technology whether a successful defense can be developed against the ICBM. But history records that no "insalvuable" weapon has ever been developed and that an effective counter almost appears with its appearance timed in direct ratio to the amount of effort devoted to its development.

The current scale of one ICBM defense effort suggests that it should be increased in intensity and expanded in scope. For an effective ICBM defense offers the strong possibility of achieving strategic checkmate as a single move. The concepts that first develop and demonstrate an effective defense against ICBMs can rule the issue

natural next but that period in the foreseeable future until new types of offensive weapons emerge to make the ICBM obsolete.

Although we get only faint sniffs of the Soviet effort at developing an anti-ICBM system, it would be foolish to assume that they are not pouring their program to the best of their available technical resources. As a nation of chess players, the importance of that move could hardly be lost on the Soviet leaders.

In the same sense, we should be devoting considerable effort today to developing defensive capability against weapons that may eventually be deployed through space, even though it is not yet clear exactly in what form the space offense will emerge as a generic thrust some year hence. Such projects as the Air Force Sait (satellite interceptor) represent a sound forward step toward solving the defensive problems of tomorrow, even though its details would be like science fiction to the teenager today.

But one area in which we find ourselves in serious defensive difficulty is the old-fashioned business of an defense against manned bombers. Based on a combination of forty intelligence and careful thinking on military leaders of some years ago convinced themselves that the Soviets had abandoned manned bomber development and that it was safe to let our air defense system deteriorate into eventual obsolescence.

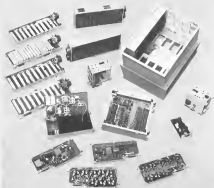
There is still some effort at the top level in the Pentagon to discuss the Soviet response bomber and tanker developments with the hunched, third man between seats of "The Russians aren't 18 ft. tall," and "How do we know these new Russian bombers aren't just prototypes built to fool us into going in the wrong direction?" This was the same sort of warlike posturing by the Central Intelligence Agency after the 1956 Tashkent air show. Despite the protestations of Messrs. Dulles and Khrushchev, the Soviets have continued development of manned flying machines across the entire technical spectrum from supersonic bombers to helicopters and conventional fighters.

It is against the threat of the new Soviet supersonic bombers with their high-speed jet tanker support, come armed with the old Bore and Bulger bomber fleet equipped with stockpile missiles of sufficient range to avoid Nike Hercules and make the Bomarc B and the F-106 systems of marginal effectiveness, that our defense are critically weak. We once had adequate military plans to counter this future threat with the long-range F-106 Mach 3 interceptor and a modified SAGE and DEW-Line system. But all of these plans were scrapped on the ground that no such future threat would exist.

In our current preoccupation with the development of a variety of technically sound new offensive weapons, we should not neglect a more extensive and intelligent evaluation of just future defensive requirements than we have devoted to that area in the past.

—Robert Hiltz

- 16 Converter assembly— analog input
- 7 Digital input processor
- 8 Housing
- 9 Programmer
- 10 Low-level amplifier and super multiplexers
- 11 Analog to digital converter
- 12 Arithmetic, drift and gain compensation networks
- 13 Output filter
- 14 Power converter



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WHO'S WHERE

In the Front Office

J. E. (Shag) Gaskin, vice president in charge of the R & D section, General Dynamics, Ft. Worth, Tex., and M. L. Hilde, vice president legal and procurement.

Robert L. Towner, executive vice president, development, research and a director of Project Apollo, Los Angeles, Calif., and a director of Project Apollo, Los Angeles, Calif., and a director of Project Apollo, Los Angeles, Calif.

Manuel B. Bennett, vice president, research and development, General Dynamics, Inc., Torrance, N. Y. (division of General Dynamics Equipment Corp.).

F. F. Rindler, vice president, General Dynamics Corp., Torrance, Calif. Mr. Rindler is in the company's director of marketing.

Robert W. Ruch, president, Data Technology Corp., Palo Alto, Calif.

Barry L. Thompson, vice president in charge and engineering, United Aircraft Products Inc., Dayton, Ohio.

Robert C. Lockwood, executive vice president, Instruments for Industry, Inc., Richland, N. Y.

Telecomputing Corp., Los Angeles, Calif. has named Vice President David T. Kitchell as general manager for both the Windows Controls and Windows Data Systems.

Mag. Gen. John A. Bartlett (USA, ret.) was promoted recently and development of the Lunar Corp., New York, N. Y.

Dore Gendron, vice president, general and industrial operations, Chicago Edison and Telecommunications Division of the Seacor Corp., Los Angeles, Calif.

Dr. Stuart E. McEwen, a vice president and a director, Astronautics Research, an affiliate of Princeton, N. J.

Richard F. Fisher, vice president and a director of public relations, National Air Force, Inc.

William Watkins, regional vice president, Washington, D. C., was appointed, American Corp.

W. O. Chaschka, vice president, market and research, D. C., was appointed, American Corp.

W. H. L. Lander, executive vice president, operations for Fairchild Industries Corp., was appointed chief of Washington, D. C.

Clara W. Minor, vice president and assistant general manager, Mechanics Division, Inc., was appointed chief of New York, N. Y.

J. E. Tinsley, vice president in charge, American Instrument, Manufacturing Corp., Houston, Tex.

Col. Karl N. Baker, chief of the Texas Instruments Division, Texas Instruments Corp., Houston, Tex.

Col. James D. Butler, executive chief of the Sciences of the Air Force, Los Angeles, Calif. 1. Information Office.

Honors and Elections

B. C. Villiers, executive director of Astronautics, has been elected president of the Astronautics and Space Institute, Inc.

(Continued on page 107)

INDUSTRY OBSERVER

► The new trading site for the initial scheduled test flights will be at Minotaur Point, near Santa Rosa Island and Recife, Brazil. These sites are approximately 1,100, 1,600 and 4,200 mi. respectively from Cape Canaveral.

► First Centaur test launch is scheduled for November. It will be a full-scale flight.

► In two places to be the Centaur partial guidance system package in its final mission with several months. The Centaur guidance system consists of a four-part guidance package, including a Minotaur (Hawthorn) and a Lufthansa digital computer (AWT-6, p. 65).

► New's Radiological Defense Laboratory is conducting a series of 35 radonmeter chemical high-explosive detonation tests of San Clemente Island in a study of nuclear-military weapons effects. Study called Project Hydra II test is scheduled to the Project Hydra test launch event.

► National Aeronautics and Space Administration plans to buy at least five and possibly 10 more Lockheed Agusta B space stages by early 1965 in addition to the five now programmed. The vehicles will be used in tests of various Apollo vehicles.

► Research chamber now in operation at Arnold Engineering Development Center can produce partial vacuums as low as 4.7×10^{-6} millitorr of oxygen, equivalent to pressure at about 375 mi. altitude. Working space is 8 ft. in diameter and 15 ft. long. Low pressure is achieved with oil diffusion pumps equipped with liquid nitrogen-cooled baffles and with mechanical pumps. Limit the facility at 100 sec. outgassing, which involves condensing gases on very cold surfaces.

► Air Force and Douglas are attempting the first precise simulation of aircraft structural fatigue produced in flight with fatigue produced by test rig. Various profiles are being flown by a C-119 transport and duplicated in a test rig built at the Douglas Long Beach plant. The program is expected to improve reliability of projections based on ground tests.

► Air Force is showing increased interest in microsatellite sensing devices for use in very high altitude aircraft. A reconnaissance laboratory will be established soon in the High Altitude Laboratory at Aerospace Systems Division to evaluate such devices as microsatellite altimeters, sensors, sensors and detectors.

► Mid-flight error tolerances demonstrated at the recent Testbed air show can hit 1500 ft. (1500 ft.) according to a Russian technical source. The M-45, from which the flight error was developed, has M-45 12 metric tons in an altitude of 7,570 ft.

► System launch Complex 37 at Cape Canaveral will accommodate fueled boosters. Launches will be moved from Complex 34 to Complex 37 after the first four flights. M-45 34 is being converted to handle fueled boosters.

► Test 31 launch complex at Cape Canaveral consisting of modified M-45 31 and 16-m. thrust engines. With Test 31 unable to handle the weight was not added within the explosive had storage area the Area Corps of Engineers has estimated a 16,600 lb. radius semi-circular area in the adjacent Banana River as a safety precaution.

► Minuteman-Atlas 6 payload was sent to a champagne on an orbital flight of M-45, carrying a "champion" nose in orbit, and M-45, the first orbital change flight, was not completely successful. If the first two orbital tests are completely successful, M-45 will be a named flight.

► Air 404-shaped VQOL research vehicle is now undergoing test and evaluation at NASA's Ames Research Center.



WHY MORE ENGINEERS ARE SPECIFYING LIBRASCOPE ENCODERS

New design features in Librascope encoders have sharply reduced noise and eliminated ambiguity, while adding many hours of useful life. Among other features: faster operating and slowing speeds, accuracy you can depend on. And Librascope encoders have proved reliable in more than 15,000 military and commercial installations. Librascope now builds 132 encoder models with a variety of capacities, output codes and case sizes. It's probable that one of these encoders will satisfy your shaft position-to-digital conversion requirements. For the details, tell Librascope's engineers your applications and requirements. They'll promptly recommend the best encoder for the job. Just write to Applications Engineering, Librascope, Glendale 1, California. In a hurry? TWX us collect at BXB 888.

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Washington Roundup

Sole-Source Buying

Perkins has two specific actions under way to begin reversing the trend to sole-source procurement, but Defense Secretary Robert McNamara has warned Congress that it may take five years to realize dollar savings. He says no large of existing contracts will be renegotiated, with only new contracts in the near future.

Industry is not likely to welcome the new device he plans to use—requiring that drawings and specifications under any development contract be prepared according to a specific timetable so they can be turned over to competitors immediately when the time comes to bid on procurement of the item.

McNamara's second step is to have a group under Scudling Librascope review all sole-source procurement procedures in a search for other ways to reverse the trend. McNamara explained to the House Armed Services Committee that there is only one source for the Lockheed C-141 and Republic F-105s needed for the rapid buildup of conventional forces. For example—and to add a second point would take too long. For reasons such as these savings lie only in the future. But I can absolutely guarantee the action we are taking will lead to that result eventually." McNamara said.

Total Budget Picture

Congress has received a diplomatic suggestion from Budget Bureau Director David E. Bell that it establish its own equivalent of the Budget Bureau. It is being repeated in hearings in the budget. Congress now needs responsibility for the final total figure. Budget Bureau must not lose progress against the deficit and all programs require explicit action in forming a national budget.

Tight control placed on the military services' Study Requirements at the Defense Department level will continue for an indefinite period. The reasoning is that companies assign their most talented scientists and engineers to the studies whether they're funded or unfunded, and that more immediate high priority projects suffer as a result. As Time with main ideas for military space applications, has encouraged the greater number of studies.

Secret Consultant Yon Goggin apparently has been doing the wide-area comparison between U. S. Assistant Alex Shoup's flight-in which Shoup controlled the cosmic launch—and Goggin's on a flight. Goggin has been denied that he "let" his own aircraft, but agreed with Soviet statements that it was controlled from the ground but he told no commander on his arrival trip to Cuba. "It seems to me there is no point in sending a man into space when the operation is managed by the man. I was the direct controller of the flight. I directed the entire flight of the space ship."

Anti-Trust Threat

Possibility that the U. S. might sue American Telephone & Telegraph Co. to divert stock of its common operations has further complicated the communications industry question. See p. 20. Assistant Attorney General Lee E. Swanger who heads Justice Department's Antitrust Division, said under questioning in the Senate Small Business Subcommittee on "Monopoly" last week that this question is under consideration. He later tried to modify the statement, but he remains in danger the company's stock, he said, and brought a protest from company spokesmen. Current telephone calls represented one-half of one per cent of AT&T's business last year, but those calls are expected to grow by a factor of 25 by 1980—and it is doubtful for this reason that AT&T is not a communications utility.

President Kennedy's letter to Commerce Secretary Luther Hodges asking for recommendations on improving the nation's transportation facilities represents a shift in Administration planning. Earlier this year presidential assistant James Egan's report needed that the White House took federal regulatory agencies—and it appeared that Egan's probable would be asked to develop an overall transportation and commerce law, plus.

Congress moved into the picture with a message drafted last spring for the President's delivery to Congress. It was a presidential assistant James Egan's report needed that the White House took federal regulatory agencies—and it appeared that Egan's probable would be asked to develop an overall transportation and commerce law, plus.

Pentagon Tonic

Latest suggestion making the words of Pentagon officers is to combine Navy's Bureau of Ships (BuShips) and Bureau of Weapons (BuWeaps) to form BuShipsWeaps. In that, of course, could be Vice Adm. Robert D. Brown, the only U. S. Navy admiral with a beard.

Carl Otto Glom, chief of Air Force Systems Command's Special Projects Office and special assistant to AFSC Commander Gen. Bernard A. Schriever, is working for 90 days in National Aeronautics and Space Administration's Large Launch Vehicle Planning Group, apparently in a USAF representative in the NASA Defense Joint Launch Study Project.

—Washington Staff

Kennedy Moon Budget Approved by Senate

Washington—Senate last week approved the bill \$149 million requested by the President to accelerate National Aeronautics and Space Administration's lunar program in joining the Fiscal 1982 independent offices appropriation bill.

The request was submitted late last year for consideration in the House when it died in the legislature. That it will be one of the first for defense from its parent House-Senate conference committee.

The Senate committed to a \$15 million lunar House addition to other NASA programs \$69 million for science and equipment \$17.5 million for research and development and \$12.8 million for construction of facilities.

House-Senate differences, placed in the joint conference included:

- **Civil Aeronautics Board.** The Senate wanted a \$5 million increase in the House and voted the bill \$10.7 million added to CAB for airline subsidies. That included \$6.9 million for helicopter services, compared with the \$5 million offered by the House. A new law in the Senate floor, led by Sen. John Williams (R-Ind.) to eliminate the crisis, \$6.9 million for helicopters has not defeated 61-28. Senate allocated a \$19.9 million cut in CAB's \$9 million request for salaries and expenses.

- **Federal Aviation Agency.** The Senate made three increases over funds voted by the House in FAA's budget: \$12.6 million for operations, \$4.6 million for facilities and equipment and \$2 million for development of a supersonic aircraft (see p. 58). It eliminated \$6 million added by the House as the FAA request to speed construction of Dulles International Airport. The total FAA budget voted by the Senate was \$7.6 million below the agency's \$744 million request and \$15 million more than the amount approved by the House.

Modified Airport Bill Approved by House

Washington—House voted last week to authorize \$777 million over five years to help states build and improve airports—such as an amendment to permit the Federal Aviation Agency from operating an airport at Mitchell Field N.Y. if local officials object.

The House passed legislation after benefiting from the bill pending in the Senate on how the report comes to be appropriated. The House, however, gave the appropriations committee the power to divide the funds into three bills, be spent each year for airports, while the Senate bill would authorize the

FAA to commit federal funds with an advance.

Under the Senate bill, the FAA could get the necessary money directly from the Treasury Department if Congress did not appropriate it. The Kennedy Administration favors this approach (AW July 10, p. 41).

Chairman John R. Williams (D-Ala.) of the House Transportation and Infrastructure Subcommittee said the bill provided a compromise between non-federal funding and the so-called "hardship spending" method. Under the bill, he said, Congress could appropriate money directly to an airport to let the five-year period authorized.

Rep. Steven B. Dymally (D-N.Y.) offered the amendment relating to Mitchell Field, which has a big dispute. He said he wanted to "clarify" the situation there, which there is a major light tower, whether part of Mitchell Field should be used for an airport after it becomes surplus property. FAA Administrator Nighthop T. Hildes has been accused to sell about half of the Air Force base for a general aviation airport.

Chairman Owen Harris (D-Va.) of the House Interstate and Foreign Commerce Committee ruled no objection to the amendment, but reserved the right to propose it since the airport bill goes into a House-Senate conference to compromise differences.

Senate Group Defines Supplemental Rules

Washington—Senate Commerce Committee last week unanimously agreed to a bill to establish guidelines for Civil Aeronautics Board operation of supplemental air routes.

For the first time, the bill defines "charter service" for supplemental air as well as scheduled carriers. The measure would give CAB less authority than it formerly had over supplemental carriers by requiring the Board to follow specific criteria set forth by Congress.

However, the bill facilitates the present selection process regarding charter service by allowing supplemental as well as scheduled carriers to transport people on express paid tours, regardless of whether they are being to the same region or not. The supplemental line might elaborate plans to transport Europeans to the U.S. on express paid tours.

The Senate bill defines charter service as "any transportation performed by or on behalf of a carrier for a number of public passengers and aircraft, other than, except, or one or more in which has been engaged for the movement of persons and their baggage or for the movement of property, on a non-advised or irregular basis, but shall not include transportation services of food to an air carrier or individual

members of the general public or performed by an air carrier under an arrangement with any person who provides or offers to provide transportation services to individual members of the general public other than as a member of a group on a scheduled basis.

A restrictive section in the bill would require the CAB before giving supplemental routes to individuals selected authority to determine that there would be no "significant" diversion of traffic from existing airlines. A committee spokesman said the net effect of this provision would be to require the supplemental carriers to replace the points they would serve either than providing them to its members they would under the traditionally scheduled airlines. Also the CAB would have to show the proposed supplemental service was a public necessity.

Another section of the bill would simplify procedures for the supplemental to follow when taking business that the scheduled carriers could not handle. In peak traffic periods, CAB could force supplemental to operate 70 days operating weekdays. The authority could be increased twice in a total period of 90 days. The bill also would require the CAB to file supplemental up to \$1,900 for each day they operated operations.

The House Transportation and Aeronautics Subcommittee has approved a bill giving the CAB more latitude over the supplemental than would be allowed in the Senate measure. But the current House Interstate and Foreign Commerce Committee has not approved the bill. Supplemental air carriers currently are operating under temporary, congressional authority scheduled to expire in March 1982.

Tushino Not Altering British Air Policies

London—Despite of Russian air might at Tushino last month (AW July 19, p. 41) will have little, according to effect on Britain's domestic efforts, John Avery, secretary of state for, said in the House of Commons.

"Nothing seen at Tushino alters our view that the Venerable House with the necessary improvements already planned as its offensive capability, will remain a valid deterrent for the rest of the decade," Avery said.

The improvements he mentioned are modernization of the Blue Steel standoff bomb and the Douglas Saboteur.

Turning to strategic airlift capabilities, Avery said the Royal Air Force will be 5% in the Short Britain freighter, due for delivery in 1984, although most critics had been given to ordering the Lockheed C-130 as an interim aircraft. This approach has been dropped.



New of mid-engineing Soviet Su-26 aircraft appears under the more symmetrical configuration below.

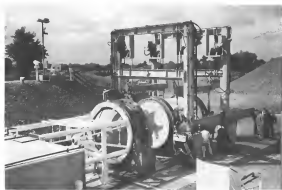
New Photos Show Beauty Area Ruling, Nose Shapes

New photos of Russia's Beauty have been taken from extensive view taken from the cockpit.

Design behind wing is added as, probably, to compensate for loading. The wing is strong to then handle high speeds to accommodate aerodynamics. Wing sweeps sharply at mid-possibly a device to extend the chord to delay stall. Tail wing edge, with flap between blades and fuselage and conventional shape, can be moved slightly. Nose of nose on wing (top) differs markedly from that of nose on wing (right).

Later may be a semi-circular nose. Cylindrical fits a hinge behind intake on the left and extending up fuselage could house forward looking and oblique camera. Unusual feature is second set of tips of the horizontal tail. Fan says (below) shows close set engine nacelles, which look long, sometimes narrow, because of low position. Wing lower nose and open controls with the advanced design of the engine exhausts. Tip picks up wing area under to those on tail surface of two sets. Engines seen at Tushino (AW July 26, p. 26), and the Russian heavy bomber.





Turn-lift moves each segment of Aerojet-General solid fuel rocket motor into position to mate with forward segment prior to firing.

Aerojet-General, UTC Test Solid Rocket Components



Major segments of Aerojet-General motor (above) are prepared for firing at Sacramento, Calif. facility. Sections can be casted in less than five minutes under field conditions, company claims. Motor generated nearly 900,000 lb thrust during 40-sec firing. Second segment test case for United Technology Corp's 180,000 lb thrust solid propellant F-2 motor (right) is set up for hydro-test at Pratt & Whitney Aircraft's East Hartford, Conn. facility where it was constructed. Rate diameter is 30 in. (appears to be in diameter at bottom of top segment). Motor 40 ft long is expected to burn about 140 sec during long tests scheduled tentatively for mid-October. Main tube of the motor will be approximately 0.90



Taped Tracking Data To Guide Zens Shots

Pl. Mags, Calif.-Nile Zens airborne missile forces scheduled to be gone here but Sahara will parallel a series of dry runs in which the target intercept computer will be fed the taped tracking data of USAF ECM targets from Cape Canaveral. Data was collected by a Zens target track radar at Ascension Island.

This is an actual target track radar in the 21 Mags' controllers and the measured guidance data will be entered without an actual target until test activities move to Knappton in the Marshall Islands. The test Knappton track is scheduled for March (AW Apr. 15, p. 71) but since the 21 Mags tests are meeting several needs ahead of original schedules the Knappton test run also will be moved up.

The first targets will be short-range Spotted targets launched from the island of San Nicolas. Chief of the development program will be test agent Adm. Arnold, launched from Vandenberg AFB, Calif.

Eastern Reorganizes Its Top Management

Eastern Air Lines has reshaped its top management group in partial direct executive suggestion of all of the company's operations.

Under the new plan, now in effect, four new posts of executive vice president have been created to provide a run level of executive authority directly responsible to Eastern's President, Nicholas A. Mauryer. The company's board of directors also elected four new vice presidents to complete the company's management plan. Capt. Eddie Reichenbacher named chairman of the board.

First vice president division will be headed by Robert L. Turner, who has been elected to the new position of executive vice president transportation services, as well as to the board of directors. Reporting directly to Turner will be newly elected Paul Shapiro, vice president-passenger services; Robert Springer, vice president-flight operations; Aubrey L. Chabot, vice president-aircraft maintenance; and Don C. Miller, assistant vice president and director of communications.

Mauryer Reichenbacher who has been elected executive vice president-staff services, will head all activities pertaining to scheduling, money, related administrative communications, technical engineering properties and related communications relations. This second management division will include Robert N. Lipp, elected vice president-mail and commerce services; and Warren B. Ware, Jr.,

newly vice president schedules and planning. A third management division is headed by Capt. John H. Hollister, company vice president-administrative services. This division will conduct all activities concerning operating bases, airports, medical services, security and standards of performance. Joseph H. Brock has been elected vice president administration in main Baltimore.

No officer has yet been named to serve as executive vice president finance in the fourth management division.

Simulated Snap Fuel Tested in Re-entry

Washington-Ten simulated, non-industrial nuclear power generator fuel test case launched 5,000 ft down the Atlantic Missile Range aboard an Atlas F missile last week in the first of a series of five tests to be conducted this year in the Air Force's Air Force Research Laboratory.

The flight tests are to determine the temperature and heating rates of a clean-powered device during re-entry from orbit and are expected to prove that Space Nuclear Auxiliary Power (SNAP) units will have up launchable, at this point.

Instead of isotopic cells, one cylinder carried a tube of sodium and the other contained plutonium. Placed in body of Atlas capsule, the capsule-shafting with a kilometer capsule, now covered in a 35 ft long, 100 lb, package mounted externally on the General Dynamics Atlas.

At an altitude of about 90 mi., the package was released from the Atlas and placed in a ballistic trajectory. Prior to re-entry, the package itself was split open and the three capsules opened. Sensors along the thousands of miles of the sodium capsule monitored the temperature rise, and the data was transmitted to ground stations.

The other capsules skidded under the high re-entry, temperature and complete disintegration was noted by the spectra of the sodium and potassium.

News Digest

Space Technology Laboratories will be given responsibility for systems engineering and technical direction at NASA's Research and Space Administration, independent of the present communications satellite program located in Project Reliance, under recently released contract from the space agency. Robert G. Gage of America has the general contract for developing Relay satellites (AW May 22, p. 27).

Ranger space probe, originally scheduled for launch on July 17, has now been postponed until late this month, when the sun, earth and moon are in the right relative positions. Technical difficulties had prevented NASA from launching the vehicle within the 5-day astronomical "window."

Antennas using London's international aspects will be charged for technical services such as air traffic and air route control (AW Apr. 17, p. 45), in addition to landing fees now paid, when the new services take over partially in 1983-84 (see p. 43), according to Mrs. John of Aviation Policy Commission.

Paul J. Larson, Minneapolis-Hennepin vice president in charge of research, has been named assistant Avionics secretary for research and development.

Three Soviet cities will be visited by a complete Gemini 173 Shalov's business plane, which will be part of an exhibit sponsored by the U.S. Department of Agriculture and the American National Association of Airports. The plane will spend 21 days each at Moscow, Stalingrad and Odessa, beginning in mid-September. Two cities in the east.

USAF Electronics Systems Division will submit safety proposals for its nuclear deliveries and reporting in 1971. The program will be directed by an Air 18 with ESD Command, Hannon Field, Bedford, Mass.

Donald L. Phillips became president of General Electric and C. W. LaForte became executive vice president of rock. Phillips, former GE computer, replaces Ralph J. Corbin, who was acting president and who will remain in charge of the board and chief executive officer. LaForte, former vice president and group executive for electronic and light systems group, moves into a newly created position.

Strike action set for midnight Aug. 7, was served by the Engineers and Scientists Guild on Lockheed-California Co. The ESG, representing 2,700 Lockheed employees, has called for pay raises ranging from 3 to 5% effective at the expiration of their contract.

Four bulk of Eastern's Model III separate fighters has been delivered to the French on leave at Dijon.

Avionics evolution tests will look into the use of a new radar, a powered helicopter in the next 10 weeks at the company's Trent, Tex., plant and probably will be given a flight demonstration of its capabilities. The B-10 is an enlarged urban version of the B-10-1 series.



DOUGLAS AIRCRAFT CO model of a supersonic transport design shows the double delta wing planform with tips that droop for laminar flow at Mach 3 cruise. Length of the proposed aircraft would be 200 ft; wingspan 150 ft, with the wings extended for subsonic flight. Under study for four years, the aircraft would cruise at 70,000 ft., operate at 100 mile rates comparable to present jet transports, and be capable of using existing airports (AW Feb. 24, p. 13)

Senate Votes Mach 3 Transport Funds

AVIATION WEEK ARTIST'S rendering shows current thinking of North American Aerospace design team which studies a supersonic transport configuration derived from B70 geometry but using aerodynamic advances available since the Mach 3 bomber was planned. Note narrowed upper fuselage configuration and changed wing location.

Washington—Development of a supersonic transport under a joint congressional-industrial program aimed fiscal congressional approval last week, when the Senate voted \$12 million in research funds following an attempt to kill the program.

Supporters view development of an experimental Mach 3 transport as a major step toward the goal of engineering a larger share of the world market for U. S. aircraft manufacturers. The development effort could cost as much as \$700 million.

Federal Aviation Agency Administrator Nilsen E. Haldane announced in testimony before Congress this week that the Soviet Union or some other nation might lead the U. S. in development of a supersonic transport but he emphasized that the U. S. wants the first commercial, competitive, return, whether or not it is the first to fly. Russia has indicated it also is taking a first design approach to the supersonic transport, rather than concentrating a military research (AW Feb. 11, p. 30).

The Kennedy Administration has appropriated \$12 million for fiscal 1962 to support industry research on the transport. The House voted to appropriate \$10 million, while the Senate voted for its \$12 million last week after deferring on a 75-55 tie vote an amendment by Sen. Stuart Symington (D-Mo.) to eliminate the \$12 million previously approved by the Senate appropriations committee.

Symington's Protest

"I would not protest this vote [for \$12 million]," Sen. Symington said in urging the amendment on the floor. "It was not for the fact that I do not see how the government could refuse to agencies, which it is doing, in the development of a program which for the B70 a million Mach 3 aircraft, at the same time, it subsidizes for industry a



CONVAIR supersonic transport concept has delta wing with tip-mounted outboard engines.

Unlike B58, it has horizontal stabilizers.

comparable experimental Mach 3 aircraft."

Fiscal decisions on the funds to be appropriated for the supersonic transport was left to House-Senate conferees working out a compromise independent of the Senate bill, which contains the funds for FAA and the National Aeronautics and Space Administration. In both the House and Senate-passed bills, NASA is slated to get \$8.5 million for supersonic transport research (see p. 77).

The \$12 million requested by President Kennedy for fiscal 1962 for FAA to expand research on the supersonic transport is to be followed in another request for about \$28 million to continue the work in fiscal 1963. At the end of the two years the government will decide whether to subsidize further the development program or leave the program entirely up to private aircraft companies.

Haldane, as head of the Federal Aviation Agency, will be the principal administrator of the supersonic transport project since most of the research money will go to his agency. He told the House Science and Astronautics Committee last week that the aircraft program will mark the first time the federal government and private industry jointly develop a commercial airplane.

Subsidy Justified

He said the federal subsidy is particularly true, the aircraft industry cannot afford to develop the supersonic transport on its own. Yet, he argued, development of the transport is in "the national interest" since it would help stimulate a new segment of the economy.

"Our goal," Haldane said, "is the production in the U. S. of the world's first commercially competitive, supersonic transport. Our aim is the best transport. It might not be the first, but we want it to be the best." He said U. S. commercial aircraft manufacturers will be "in rough shape in the world market

if Russia produces such a transport first, but he brushed off suggestions by opponents, asserting that more research money be appropriated to hasten U. S. development work.

Haldane said that under current money requests "we're pursuing a sensible program that is technically feasible and will pay off in the end."

B-70 Limitations

Both Haldane and Sen. E. Albert, director of NASA's Office of Advanced Research Programs, said the B-70 development program would not yield all the answers to technical problems connected with a supersonic transport airplane. Albert said the transport's development "will require the evolution of a new attitude for government support."

However, in addition to subsidizing private research on the supersonic transport, Albert said NASA now hopes to use the B-58 bomber in flight "to study more of the stability, control and plotting problems that supersonic aircraft would encounter in transport operation."

NASA, USAF Explore Aviation's Future

Washington—National Aeronautics and Space Administration and Air Force officials explored the future of manned aircraft last week, probing an era which will make all previous aeronautical projects look like a compromise.

"For times beyond that, we cannot see ahead of ourselves," Dr. H. H. Aldrich, NASA director of the Office of Advanced Research Programs, said. "We believe it stands on the threshold of its most rapid advancement. . . . We are concerned at the continuing importance of aviation."

Albert said that although coming generations of aircraft "will make all previous aeronautical projects seem slow," NASA said this year has had enough money about equal to that spent in 1947-48 by an predecessor, the National Advisory Committee on Aeronautics. He said although the \$10-million fiscal 1962 advance requested for the \$51 million NASA spent in fiscal 1961 on aeronautical research will take care of immediate needs, "I personally believe that a future increase will be a needed next step."

Since its formation in 1958, NASA has centered research in the V-470, an earth field, Albert said, and intends to continue a "supersonic program." He said the distinctive breakthrough made at the space program promises to provide the technology needed to enable V-470 aircraft with the necessary precision.

In the supersonic field, Albert said NASA is concentrating on the Mach 2.4 X-15, adding that now "all supersonic aircraft look the same, to which we have become accustomed in reference aircraft and variable in this regard the aircraft of 30 or more years ago."

May Gen. Boaz K. Holloman, Air Force director of operational requirements, told the House space committee that his military services also had the manned aircraft will continue to play a vital role both in war and peace. He said the tactical fighter "must maintain the backbone of our weapons of limited war for the indefinite future." He added that the services hope to have the "T-10 fighter," "the greatest" working five years, as a replacement program to serve the tactical fighter and interceptors of all three military services. Gen. Holloman said that although the T-10 will be a STO, airplane "we are still very much interested in V-470 aircraft." He also pointed out that a major effort, headed by the Navy, is under way to develop a new V-470, transport.



New York Airways Vertol 107 Makes First Flight

Bearing Vertol 107 helicopter, helicopter used by New York Airways makes its first flight at Westbury, N.Y. The plane has a total of 135 seats, 25 passengers, 107, which are powered by two GE T58 turboprop engines, for delivery later this year.

Helicopter Service Recommended For Transportation to Airports

Washington—Helicopter service not only is feasible, but also is a high way to an increasingly busy airport, according to a study prepared by the Federal Aviation Agency.

Prepared by Hansen Systems Research, Inc., the 400-page study concludes that helicopters "offer considerable potential benefits, but at least a partial reliance is required transportation facilities." It also states that only the helicopter solution in its field is both practical and feasible.

The study also states that the helicopter solution is a new concept in airport transportation. It also states that the helicopter's presence is generally added to the typical airport's facilities, but passenger operations and destination points are not. The study also states that the helicopter's presence is generally added to the typical airport's facilities, but passenger operations and destination points are not.

Even though the building of better access highways would shorten vehicle travel time to the airport, the study also states that the helicopter solution is a new concept in airport transportation. It also states that the helicopter's presence is a new concept in airport transportation.

Air France 707-328 Crashes in Hamburg

Paris—On July 28, 1971, an Air France 707-328 crashed in Hamburg, Germany, on its way to New York City. The plane was on its way to New York City, and the crash was the result of a fuel system problem.

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Carriers Briefed On Lockheed Model 300

Washington—Lockheed Aircraft Corp. has started briefing potential airlines on the performance and specifications of the Lockheed Model 300, a new transport aircraft.

The aircraft is a new transport aircraft, and the briefing is being held to inform potential airlines of its capabilities.

British SST Decision

London—Decision on British development of a supersonic transport is not yet made within the next two to three months, according to Sir Matthew Smith, British CAA chairman.

Smith concluded that a supersonic transport will not be a viable option for the next two to three months.

Smith also stated that a supersonic transport will not be a viable option for the next two to three months.

Beacon Favors Proven Control Concepts

By David H. Hoffman

Washington—Project Beacon report will indicate that familiar tools and techniques—not radical new devices—will be used to improve flight safety.

The report also states that the use of familiar tools and techniques is the best way to improve flight safety.

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needs to participate in the IFR system. Special measures, such as an in-flight velocity of air, will be used to improve flight safety.

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Hijacking Problems

Washington—Federal Aviation Agency is studying the problem of hijacking on international flights.

The study is being conducted to determine the best way to handle hijacking incidents.

The study is being conducted to determine the best way to handle hijacking incidents.

By Herbert I. Coleman

The Ministry made some progress since also a parliamentary Subcommittee on Estimates reconsidered provision of an authority on the basis of the Part of New York Authority, to streamline operations and cut costs in a report highly critical of business controls and planning.

to the expansion of output available

to the expansion of output available

for civil flying in the London terminal area and the establishment of traffic control for military and civil aircraft in one control system.

- Reduction of the overcharge on landing fees possible for aircraft landing after an environmental flight
- Calculation of a differential on landing fees at Heathrow near London

- Facilitation of use of Garriick for business and private airplanes
- Transfer of all airport services to

Deaths in the interest of safety as well as responsibility for camp buses. Passenger seating charges should be standardized and the 7% rebate to airlines for collecting this fee should be

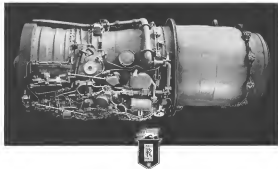
- *Duty free shops should be provided
- and construction of a multi-story car park should be expedited for Heathrow.
- *Ministry of Agriculture should assist with

- Ministry should evaluate all possibilities of expanding on range initiatives at London.

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[illegible]

10



BY-PASS JET

ROLLS-ROYCE SPEY ENGINES WILL POWER THE de HAVILLAND TRIDENT, THE BRITISH AIRCRAFT CORPORATION ONE-ELEVEN AND THE BLACKBURN BUCCANEER.

The By-Pass principle proved by the Conway is now accepted as the correct formula for jet transports

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Airline Income and Expenses—May, 1961

506 COLLAPSE

	Passenger Revenue	U.S. \$ Mil.	Revenues	Passenger	Crews	Total Operating Revenues	Total Operating Expenses	Net Income Before Taxes
DOMESTIC TRUNK								
American	31,708,167	268,677	381,712	1,234,867	—	35,661,244	34,331,302	740,132
Boeing	5,502,420	46,847	63,487	244,782	20,734	6,454,171	6,314,902	139,269
East	7,351,136	61,618	77,913	342,387	28,210	8,343,421	8,348,422	(4,991)
Continental	4,432,026	36,869	51,008	145,266	3,698	5,042,058	4,806,488	141,080
Delta	10,077,123	83,977	103,000	344,969	—	11,122,092	10,988,000	134,092
Eastern	18,721,123	155,281	197,000	724,848	2,484	20,700,435	20,398,000	3,002,435
Midwest	2,734,870	22,811	33,671	167,124	88,483	3,183,942	4,628,162	(1,402,220)
Northwest	4,968,703	41,327	59,661	198,727	—	6,028,091	5,900,000	1,288,091
Northwest	1,800,703	14,844	20,422	400,428	(10,391)	2,030,739	2,033,237	(3,498)
Southwest	1,800,703	14,844	20,422	400,428	(10,391)	2,030,739	2,033,237	(3,498)
Texas World	1,800,703	14,844	20,422	400,428	(10,391)	2,030,739	2,033,237	(3,498)
United	18,721,123	155,281	197,000	724,848	2,484	20,700,435	20,398,000	3,002,435
Western	6,001,219	50,009	66,000	178,294	30,814	6,380,127	6,208,278	171,849
INTERNATIONAL								
American	794,302	5,800	932	48,179	—	424,424	478,836	(24,462)
Boeing	72,612	544	—	—	—	21,344	1,583,144	(1,571,800)
Continental Atlantic	2,461,336	20,149	25,321	101,211	790	2,688,252	2,688,252	—
Delta	116,800	5,800	—	2,800	—	131,000	344,800	(123,800)
Eastern	2,234,734	18,454	—	4,419	—	103,387	181,548	(78,161)
Midwest	2,234,734	18,454	—	4,419	—	103,387	181,548	(78,161)
Northwest	2,234,734	18,454	—	4,419	—	103,387	181,548	(78,161)
Per Airline Combined	2,234,734	18,454	—	4,419	—	103,387	181,548	(78,161)
Southwest	2,234,734	18,454	—	4,419	—	103,387	181,548	(78,161)
Texas World	2,234,734	18,454	—	4,419	—	103,387	181,548	(78,161)
United	2,234,734	18,454	—	4,419	—	103,387	181,548	(78,161)
Western	2,234,734	18,454	—	4,419	—	103,387	181,548	(78,161)
LOCAL SERVICE								
Allegiance	1,318,819	20,819	22,679	26,587	—	1,677,123	1,671,241	5,882
Boeing	149,474	7,424	2,423	4,770	8,666	273,679	427,845	(154,166)
Continental	584,400	4,900	6,321	23,811	2,830	1,137,177	1,176,247	(38,070)
Delta	541,742	19,212	2,424	23,811	2,830	1,137,177	1,176,247	(38,070)
Eastern	518,957	16,230	19,169	8,843	853	1,047,199	1,047,199	—
Midwest	518,957	16,230	19,169	8,843	853	1,047,199	1,047,199	—
Northwest	518,957	16,230	19,169	8,843	853	1,047,199	1,047,199	—
Southwest	518,957	16,230	19,169	8,843	853	1,047,199	1,047,199	—
Texas World	518,957	16,230	19,169	8,843	853	1,047,199	1,047,199	—
United	518,957	16,230	19,169	8,843	853	1,047,199	1,047,199	—
Western	518,957	16,230	19,169	8,843	853	1,047,199	1,047,199	—
Boeing	149,474	7,424	2,423	4,770	8,666	273,679	427,845	(154,166)
Continental	584,400	4,900	6,321	23,811	2,830	1,137,177	1,176,247	(38,070)
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Eastern	518,957	16,230	19,169	8,843	853	1,047,199	1,047,199	—
Midwest	518,957	16,230	19,169	8,843	853	1,047,199	1,047,199	—
Northwest	518,957	16,230	19,169	8,843	853	1,047,199	1,047,199	—
Southwest	518,957	16,230	19,169	8,843	853	1,047,199	1,047,199	—
Texas World	518,957	16,230	19,169	8,843	853	1,047,199	1,047,199	—
United	518,957	16,230	19,169	8,843	853	1,047,199	1,047,199	—
Western	518,957	16,230	19,169	8,843	853	1,047,199	1,047,199	—
HAWAIIAN LINES								
Alhwa	344,830	3,496	—	8,488	—	408,181	433,428	(24,247)
Hawaii Line	488,703	4,376	—	75,196	—	613,234	482,517	87,717
CARD LINES								
American Sky Airlines	—	3,713	—	783,400	1,484,000	1,757,113 ^a	149,473	26,785
Flying Tiger	374,261 ^a	—	—	—	1,728,000	2,381,256	2,123,876	156,478
Golden Gate	—	—	—	—	—	1,728,000	1,728,000	—
Golden Gate World	—	422,479	—	754,871	402,934	1,152,463	1,175,394	(22,931)
Slick	—	—	—	—	615,943 ^a	651,904	421,316	2,888
HELICOPTER LINES								
Chopper Helicopters	374,261	191,874	191,874	—	—	348,154	284,146	64,008
Los Angeles Airways	22,912	12,448	19,194 ^a	—	—	49,452	143,538	(94,086)
New York & Queens	70,548	6,239	2,482	2,844	—	906,631	220,370	18,253
ALASKA LINES								
Alaska Central	105,173	16,620	—	11,477	2,476	185,347	195,259	(9,912)
Alaska Central	47,303	5,686	—	7,452	2,468	74,213	119,908	(45,695)
Ketchikan	19,818	1,108	—	3,164	4,217	38,889	27,797	11,092
Northwest Coastal	121,827	67,792	—	41,937	243	223,467	284,130	(60,663)
Northwest Coastal	47,303	5,686	5,832	41,937	243	74,213	119,908	(45,695)
Northwest Coastal	177,524	48,211	—	48,402 ^a	3,158	355,453	283,812	156,491
Northwest Coastal	177,524	48,211	—	48,402 ^a	3,158	355,453	283,812	156,491
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Northwest Coastal	177,524	48,211	—	48,402 ^a	3,158	355,453	283,812	156,491
Northwest Coastal	177,524	48,211						

¹ One billion, others figures rounded. ² More people in 1990. ³ Percent.

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¹ *Mon. unguis* on leaves. ² *Mon.*

See the Texas Cowboys, Alaska Alhambra, Cowboys and

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AUTOPROMT (Automatic Programming for Machine Tools) is a powerful new computer language designed to broaden the use of numerically-controlled machine tools.

AUTOPROMT, for the first time, lets an engineer describe the surfaces of the three-dimensional shape he wants

milled, rather than advancing every path the tool must follow in order to machine the part.

AUTOPROMT leaves to the computer the task of automatically generating these tool paths. You describe the part to be milled and the tool to be used in simple, English-like

terms. The computer does the laborious calculating work. AUTOPROMT produces results like these: the time to mill the gearbox shown in the photograph cut to one-fourth the machine time required by conventional methods. AUTOPROMT reduced the lead time from blueprint to production from three months to two weeks.

AUTOPROMT is available to IBM customers. Call your local IBM Representative for complete details on this latest advance in Numerical Control of machine tools.

IBM.
DATA PROCESSING

Here's the way
AUTOPROMT works at
United Aircraft
Corporation



The Fred Phelps uses a conventional blueprint and pencil to enter statements in AUTOPROMT language.



The statements are punched into standard IBM cards and entered into the IBM 2080 Data Processing System. (AUTOPROMT also works with the 704 and 709 Systems.)



The 2080, programmed with AUTOPROMT, produces 6000 tool path instructions needed to direct the Fred and Whitney Co. Inc. Numerical Cutter Corporation Path Milling Machine.



Punched tapes direct the Numerical Cutter Milling Machine.



The Numerical Cutter mills the helicopter gearbox cover.

AIRLINE OBSERVER

► ICAO, the Federal Aviation Agency to increase the formation of a technical study group to prepare and improve the accuracy of aircraft noise installed on airline transporters. ICAO's purpose is to conduct a survey by comparing the operations between aircraft operating under commercial flight rules and to develop suitable criteria and noise criteria. Commercial aircraft noise design limits, not been changed substantially since the 1970s.

► An appeal for better in developing an entire family of air mobile vehicles, including large cargo carriers, has been made by the Russian aerospace firm. The publication called air mobile vehicles "the transport of the future." It said they represent a major qualitative jump in transportation development comparable to the appearance of jet aircraft in the late and early 1950s. Soviet design teams have been working on air mobile vehicles. It noted that several studies on foreign work in this field "have shown that air mobile vehicles have been developed partly for public and cheap services."

► Watch for Aerolineas Argentinas to sign an order for three MD-80 Conquests. This will bring total Aerolineas Conquest sales to 177 aircraft.

► Formal announcement of a contract for the purchase of three new Boeing 707-420 transporters by British Overseas Airways Corp. is being delayed until the British Air Ministry can announce further support of British projects. The new 707s will probably be used on routes to South America replacing Conquests, which will be withdrawn. Orders for 707s was prompted by a delay in the delivery schedule of Vickers VC-10 transporters. VC-10 delivery date is now fourth quarter of 1983, probably November of that year.

► Delta Air Lines has purchased four additional Conquest 550 transporters and three Douglas DC-8 turboprop aircraft at a total cost of \$16 million for delivery in 1983. This will bring Delta's fleet of Conquest 550s to a total of 16 and its fleet of DC-8s to nine.

► British United Airways, which operates a helicopter division, has asked the Air Transport Licensing Board for a ruling on whether helicopters can be operated over B.U.A.'s existing fixed wing routes without making a new application. The airline feels that the ruling could have a bearing on future operations to the Caribbean. British United has made several studies of United Kingdom-Commonwealth routes, based on Vostol 107 and Westland Reliance jets.

► Russia's Aeroflot reports carrying 25% more passengers and 16% more cargo during the first half of 1981 than in the same period last year. The figures show that the percentage gain in Aeroflot passenger traffic is not bearing its much drop, although its absolute gain was apparently somewhat less in absolute terms. During the first half of 1981, Aeroflot carried 24% more passengers than in the same 1980 period. The total gain for 1980 over 1979 was 18%.

► Pan-Canadian Airlines, competing with Douglas DC-8B transporters against Panair jet equipment, is now in the market for a fleet of turboprop aircraft. When new equipment is introduced, the aircraft will extend its terminal point to the U.S. from Miami to New York. Current loss of passenger traffic to competition is being countered by blocking off the last section of the DC-8B for cargo.

► Mexican Airlines last week opened a privately built health, transportation and customs facility at Los Angeles. The facility is capable of handling up to 100 passengers. The 4,200-sq-ft, prefabricated structure is cost \$450,000 which will be refunded, makes possible direct service between Dallas and Mexico and Mexico City without need to stop at Los Angeles to clear customs. Mexican will make this new building available to other airlines if needed.

SHORTLINES

► Air Line Dispatchers Assoc. has reexamined Stanford University's Graduate School of Business to make a complete study of the dispatcher's role in air carrier operations.

► Air Transport Assoc. reports Jack M. Mochly will become acting vice president of traffic Aug. 5. Mochly formerly was director of passenger services for Western Air Lines.

► American Airlines reports its on planes made 90,000 additional flights on company planes during the off-peak months January through June. Flights increased more than 5,000 per month and the carrier averaged nearly four flights per airport.

► Federal Aviation Agency has published a 120-page illustrated manual entitled "Airport Design: covering layout, design, building and operation of an airport." The manual is available at the U.S. Government Printing Office, Washington, D.C. for \$2.50.

► House Committee on Interstate and Foreign Commerce has legislation before it that would grant the Secretary of Commerce \$100,000 to study and analyze federal and state regulations pertaining to air lines of transportation.

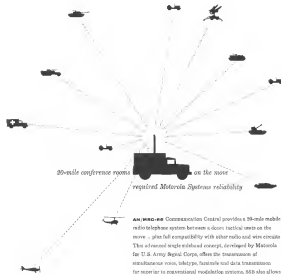
► Los Angeles Airways has forecast a total retail passenger of \$2,157,333 for its fiscal year beginning Aug. 1, including \$667,126 for service and pay and \$2,150,197 for salaries.

► Northeast Airlines President James W. Austin has told the Massachusetts N. H. Chamber of Commerce that the airline may discontinue service to 31 New England airports. The reduction would be in accordance with the New England Council's plan for regional airports and would mean better service, he said.

► North Central Airlines' fiscal year pay for service between Nov. 21, 1980 and Nov. 21, 1981 has been fixed at \$20,700,000 by Civil Aeronautics Board.

► Seawar reports it flew 45 million ton miles over the North Atlantic during the first six months of 1981, an increase of 19% over the same period last year. Turnover capacity rose 42% during the same period.

► Trans World Airlines European-based passenger air service to Los Angeles has been suspended as a result of a direct connection with a TWA commercial flight to a given city.



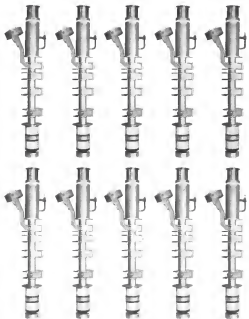
Military Electronics Division



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with one.

Today, the most powerful klystron available can produce 100KW of average power. But now, Eimac is ready to develop a klystron with ten times this capability — a klystron that can generate more than one megawatt of average power!

Impossible? Not for the company that's designed, financed and built the world's largest high voltage

DC power supply (525,000 volts at 10 amps steady current). Not for the company that's made more high power klystrons than any other manufacturer. Not, in short, for Eimac. Write for information about this super-klystron capability to: Power Klystron Marketing, Eidel-McCallough, Inc., San Carlos, California.



within the booster capability for the prescribed mission. Secondly, a control weight for thrust vector and attitude vector control authority has been established by the Configuration Control Committee which is shared by Associated Systems Division.

Aerospace's work load in the Titan Star program is reflected by the 17 members of the technical staff and six additional staffers supplied by Aerospace support groups, which are involved in the program. This staff size, in about 40 persons in a unit of which approximately 25 could be in the program office and the other 17 members of the technical staff would be supplied by Aerospace support groups and other departments.

• **Missile booster.** In addition to its responsibility for the Atlas booster in the Minuteman program, Aerospace has responsibility for the design, testing and production of the Atlas booster and for launch and flight of the Minuteman missile.

• **Present booster.** Responsibility in the program is for the Titan and Atlas Star stages, including the payload handling and rejection of payload into orbit.

• **Nike Zeus targets.** In this program, ASL, alone, handles system engineering and technical discussion as in the Minuteman, while Aerospace has overall responsibility, as in general, for the entire Nike Zeus target program, and specifically for general system engineering and technical direction over individual contractors for rocket motor, propulsion units and for non-detonation sub-systems, depending on the mission. Aerospace has the overall and the rocket to which this is assigned to the Air Force in the Army for responsibility. Minuteman rockets will be a difficult technical problem and definitely will not be in the off-the-shelf category.

Philosophy of the team of Nike Zeus team is to do precisely what the Army wants it to do to develop and enhance the Nike Zeus system. ASL's role will be to design specifications. Hence, the team will include, naturally, close liaison; problems in the early part of the program and progressively work up to more difficult design questions in the later part.

• **Star vehicle studies.** Aerospace has been involved in this program from its inception. In the closed-out program in which it is involved, because it is completely under USAF's Space Systems Division, and no other parties are involved.

One of the problems associated with Star and other programs, as well as in those, at a general acceptable open mind, is to get the most, much about Aerospace, which is in the technical direction. This is being worked out with Rocket Corp. in

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Aerospace plans contracts for the first stage vehicle.

Star is being used in which progress is being made, in defining the architecture and the means of responsibility between Aerospace's Engineering Division and the Engineering Division of the Air Force's Space Systems Division Program Office.

In addition to its functions of general control, engineering and technical direction in Star, Aerospace is concerned with interface, and specifically those between the Atlas for the upper stage, and RCA's dual stage vehicle. Aerospace will not attempt to make specifications in determining interface between subsystems in the final stage vehicle.

RCA is preparing a comprehensive detailed development plan and interface documents are being made much more specific.

Review also is being made of the interface performance specifications for the subsystems in the field of use of the search radar and techniques for construction and preservation of fuel tanks.

Aerospace has already completed specifications for the procurement of a target vehicle for the Star initial intercepter vehicle, which will be made by Space Systems Division to make the launch.

The target vehicle will have to be launched about a month before Star is launched. In proper determination of the target orbital parameters, Star is specifying performance parameters of the final stage vehicle and the target, which will have to be compatible.

The (un)planned Star booster

will be the launch vehicle for the Star final missile. Probability is that this will be the second version of the Star, but the decision is not yet made, and there is a possibility that the NASA Star will be used.

It also is probable that NASA's satellite navigation program will be coordinated with the Star program in a exchange of information.

Approximately 70 to 75 men monthly are being expended on Star general system engineering and technical direction, in which 17 members of the technical staff are engaged. Cost expected to be reduced about a year from now for the Star program is about 55 men monthly per month, in both projects, a total of 12 to 25 technical staff members.

• **Adjoint communication vehicles.** This program involves a completed aircraft program, which, which has overall responsibility, has direct responsibility for the communication package and the expenditure must now be paid in it.

In Star, with Aerospace performing general system engineering and technical direction, has responsibility for the booster for Minuteman in Minuteman II, the final stage vehicle, operation of the final stage vehicle into orbit, and for telemetry, which will include experience components and start in accurate positioning of the vehicle in the 22,300-mile synchronous orbit by command signals sent from ground stations to adjust the orbit parameters.

Army has Space Technology Laboratories on its staff as consultant for overall system engineering for the Minuteman.

next program. Probing is that this function plus the Air Force/Aerospace function in the Advanced program creates an overlapping effort which prevents duplication and long chains of technical decisions.

Advanced program will be spread over a year of time, in steps, in achieving the ultimate orbital objectives. First operational test is likely to be launched at the end of this year in 1970, next year. A very sophisticated performance vehicle will be required to put the satellite into the 22,300-mile synchronous orbit. Probability is that launch will be from a new launch site, for achievement of a satellite low-altitude parking orbit, then into a elliptical transfer orbit to achieve a 22,300-mile circular orbit. Data will be taken over a period of days or weeks followed by adjustment for a precise orbit and period.

• **Main early warning satellite.** Aerospace's technical responsibility of this Lockheed Martin and Space Division program, is distinguished from general system engineering and technical direction. One of the problems in the Minuteman type of system development is the requirement of the system for a life in orbit of approximately one year before Aerospace is conducting reliability studies. It expects to undertake other important studies in the on-orbit Main program in the near future, such as development of a broader scope system.

• **Space surveillance system.** In the on-orbit E-4 phase of Star, Lockheed Martin and Space Division has technical direction, while Aerospace has technical supervision in the advanced E-4 Star, which is aimed at intelligence retrieval by receiver. Aerospace has technical direction responsibility and Lockheed is one of a series of contractors.

In the E-4 program, Aerospace is responsible for the system and the system specifications, interfaces, the subsequent plans, test program requirements resulting from new specifications, in requirements and operation of the flight test program.

• **Walt Hand.** Aerospace has general system engineering and technical direction for this program for satellite system studies in space in both Atomic Energy Commission, Los Alamos Scientific Laboratories and Lawrence Radiation Laboratories) is associated for the design of nuclear radiation detection instrumentation.

Program for Walt Hand is launch and Aerospace will prepare a development and test plan involving early payload weight, responsibility among contractors and other program details.

• **Large wide-payload booster program.** Wide responsibility for all large launch is also achieving launch

will be under NASA production, the Air Force will have responsibility for the management, development, manufacture and test under the program. This responsibility will, in turn, involve joint decision-making by the Space Systems Division. Indications are that this large solid booster program will be put on a crash head. Head of Aerospace's Engineering Division is Vice President E. J. Brines.

This is the first of two articles on Aerospace Corp.'s operations and responsibility. The second article in series is next week's issue of Aviation Week, will be about Aerospace Corp.'s Laboratories Division.

Three British Firm Pool Service Systems

London—Atlas missile service experience of three companies within the British Satellite Group has been pooled to formulate customer requirements and achieve delivery which could ground an airplane.

The companies are Armstrong, What North Avon, the Howland and A V Roe, now working out a common program to achieve this end. Pool followed a survey of customer in various nations.

Station is based on Armstrong What North plan for the Argon 500 turbo-prop engines. The plan calls for the development of a complete off-the-shelf service for space.

• **Quantity of only load** trays for all spares to meet normal delivery and purchase orders.

• **Assurance** that the operator knows the precise service for spare parts and that overhaul arrangements are available for his particular aircraft.

A V Roe, now certifying the Argon 745 turbo-prop engine, is adapting the Armstrong Whitworth system, and both companies are working with Howland.

De Howland used the customer space service based on ATA 280 specifications developed by Air Transport Association, developing data processing of processing costs.

De Howland has developed a five-day course on major points of the aircraft involved in customer aircraft and staff, in conjunction with service schools for maintenance personnel.

In addition, de Howland pilots and flight engineers are available for assignment to the customer engine for continuing training.

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For "off-the-shelf" availability, RPI provides prompt delivery on a wide variety of low-cost, standard rocket motors. A complete inventory of parts and ready supply of limited motors is always on hand.

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Model 5	500-500	500	5.00
Model 6	600-600	600	6.00
Model 7	700-700	700	7.00
Model 8	800-800	800	8.00
Model 9	900-900	900	9.00

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**ON RECORD FLIGHT—
NEW WESTINGHOUSE RADAR
HELPS NAVY FIGHTER CUT
REFUELING TIME IN HALF**

With usering direction, a Navy F4H-1 jet fighter recently made three high-altitude rendezvous with tanker planes between California and New York. No time was lost in search or lining up for the vital business of in-flight refueling. The result was a new coast-to-coast flight record of 2 hours, 45 minutes—and the

Bendix Trophy. Contributing to the flight was a new Westinghouse APQ-72 radar aboard the McDonnell fighter. With greatly increased range over previous radars, the APQ-72 located each tanker long before it was in sight, just as in wartime it would locate an enemy target. This precise radar direction helped

cut the time for each refueling "stop" about in half. Westinghouse is proud of this demonstration of radar accuracy and the contributions of the APQ-72 to U.S. air strength.—Defense Products Group, 1000 Connecticut Avenue, N.W., Washington 6, D. C.

You can be sure... if it's **Westinghouse**





"CHERRY PICKER" crane lowers ADVENT-4 capsule during countdown at Cape Canaveral. Note my gas tank at lower right.

out and it did. It came up very slowly, when the window came up out of the water almost full size. I decided the buoy was going well out of the water so I jettisoned the rescue chute and then the capsule came up into space. Within a period of 20 to 30 sec it righted itself to a vertical position. The wave heights were very small in the capsule was riding pretty comfortably at this time and I felt I was in very good condition. I'd always been in contact with the helicopter and they were on their way to pick me up and I asked them to stand by for a few minutes while I made a check of watch position and equipment and the sort of thing that would go right on back with the capsule. In the Cape house, after I'd got this down—well, actually, before I started that—I took off my helmet. I was stripped myself and disconnected everything except my one real wrist radio which was providing me with coding. Everything else was disconnected except the communications to the helmet. I disconnected the helmet from the code on the wrist and called the rescue boat so first of all I got out of nothing around. I would sit there first. That was the first thing I did on it.

I leveled the watch dog and called the helicopter and told him I was ready to come out and as soon as he had hold of the capsule and was ready for me to come out, to give me a call. At that time I would power down the capsule, take off my helmet and blow the hatch.

While he was coming in I decided to go ahead and get a little head start on him and took off the cover on the altimeter that shows the oxygen hatch off and tested it down toward my feet. I then pulled the safety pin that holds the altimeter out. You take it out before you use it. So then I was all set and waiting for him and had him back on the beach and he

gave me a call and said he was on final and I knew that he would pick me up in 10 or 15 sec. I was now having these amazing myopia halos and Pave—the hatch went. I looked up and I saw nothing but blue sky and water starting to move in every direction. So I found me behind it. The only two marks I remember making were being my helmet off and pulling the instrument panel. I don't remember seeing any of the door. The copilot said the door came off immediately followed by a small stream out of the water. Without a doubt that was the biggest shock of day to me—the door that goes off. I must have been there. Inside I had the neck dam on. I felt I was in pretty good shape. I was looking quite high in the water, about straight back. I came, the seat does float quite well in the water with the neck dam on. I saw the helicopter there very close. He had already cut the streamer. The streamer was gone and he was crawling for the long on top of the capsule and it was making rather rapidly. It looked like to me he was having difficulty getting hold of it, but actually I gave the signal. That was the first time he had tried to snag it. So I clenched my teeth to the capsule which was only four or five feet away and was going in maybe half hour past the boat, on it. But before I got there he actually had it hooked.

Engine Trouble

I was low life but pale and the hook was on and the hook dropped off the pole, which is normal but at the time it did not look very normal to me and it thought "Oh, he lost it again." The capsule actually sank and went below the water. The helicopter pulled it back and he pulled it up. I thought "Well, so we are good shape again we have got it all and he could pick me up as soon as it gets out of the water."

The helicopter seemed to give up—probably he moved a little but I got caught in the water and got blown away. I got blown out of the water and he was having difficulty in the water. I was able to hear—nothing the capsule out of the water. The cockpit's left. He ran into an engine problem, at least we think it was an engine problem. He couldn't lift it low. These were then, helicopters. These I gave actually these were known. I built engines out of them. I was caught in the center of all these, of these I couldn't get to any of them.

I saw the small helicopter came in, put his boom collar down to get me up—the thing hanging down in the water to pick me up. I tried to get over on him but I was having difficulty getting through the water and did. I'd suggested to close a part down on my feet under the seat low down on my feet getting water on my seat. I was getting back and down in the water off the boat and it was quite hard to stay alive. But eventually, the helicopter got in close enough to me—the crew being possible getting on closer to me because the other helicopter still had hold of the capsule and couldn't get in here. For some time or other the Marine copilot said get in there enough for me to get hold of the thing and the other was pretty good for me from then on. This pulled me right out of it and got me into the USS Rascal, off of coast.

ADVENT



To create a worldwide communications system, three ADVENT satellites could be spaced equidistantly in an equatorial orbit. Each satellite, orbiting at 7000 mph, could hover in a constant position relative to the Earth in direct line of sight of approximately one-third of its surface. ADVENT is being developed for at least one year of effective in-orbit operation. General Electric's Missile and Space Vehicle Department is developing and building the ADVENT space craft and the following subsystems:

Tracking and Command to provide precise and exact information.

Positioning to assist the ADVENT satellite into its correct orbit.

Power to operate the communications and all other equipment—from solar energy harvested by several thousand solar power cells and from storage batteries for operation during eclipse.

Altitude Control to avoid ADVENT's solar cell paddles toward the sun and its antennas toward the Earth.

Environmental Control to keep equipment operating at the stable temperature necessary to fulfill the flight requirements.

telemetry to provide continuous transmission of data on equipment performance.

MOVE, a department at the General Electric Defense Electronics Division, is developing the space craft for the US Army ADVENT Program under a contract with the USAF Space Systems Division.

GENERAL ELECTRIC



ADVENT is designed to be America's most advanced military communications system. Three active repeater satellites, orbiting at 22,300 miles in space, can provide instantaneous communications among US government activities throughout the world. To help prove overall system feasibility, General Electric's Missile and Space Vehicle Department is developing the ADVENT space craft for the US Army, under the direction of the U.S. Air Force.

GENERAL ELECTRIC

STEERING BEAR FOR OUTER SPACE

BENDIX THRUST VECTOR CONTROL SYSTEMS

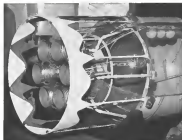
SECONDARY INJECTION: Newest way to "call the turns" in outer space. Bendix is now heavily engaged in research and development work on systems to steer Polaris and other missiles and spacecraft. This work involves the study and mechanization of means for deflecting the rocket motor jet by means of liquid and gas injection.

MOVABLE NOZZLES: Proved Bendix system, embodied in the Minuteman program. Responding to signals from the vehicle's "message center," nozzles move to change direction of the thrust, and course, of the rocket. Test firings have proved this system's reliability, time after time. The Bendix system saves 40% in weight compared with previous test systems, and has low actuation torque requirements.



Qualified contractors are invited to write for further information. Write: Bendix Products Division—Aerospace, South Bend 20, Indiana.

Bendix MEMBER OF South Bend, IND.



Saturn S-IV Model

Saturn S-IV stage's nozzle arrangement is shown in scale model. The S-IV will be second stage in Saturn C-1, third stage in Saturn C-2 (SAW May 5, p. 39) and is projected for incorporation in Nova space vehicle (SAW June 18, p. 22). The Douglas S-IV stage will contain six Pratt & Whitney LA 119 liquid hydrogen-fueled engines equipped with combined thrust of 90,000 lb. Stage IV will be 220 in. in dia., 53 ft. high.

U.S. to Help Finance British Midas Station

London—United States will spend \$25 million and provide technical help and equipment for a British resident station tool in with the Midas satellite tracking system.

Julian Amery, British secretary of state for air, said the station will be sited in the Royal Air Force at Rixcliffe, Cambridgeshire, and will be complementary to the BMEWS system now under construction at Fylingdales. United Kingdom will contribute from \$5 to \$6 million toward the project besides providing the station, which has been aimed for some time. It is near the town of Carlisle.

Amery said the station, which will be connected with NATO, and RAF Boscombe Down will give about 6 min. warning of ballistic missile attack, against 4 min. for BMEWS. He declined to say when it would be operational but noted that a previous value will be in detecting missiles fired from submarines or surface vessels from sea or point in the world.

Equipment at RAF Rixcliffe, which will be installed by the United States, includes three 108 ft.-dia. antennas. The station will be jointly owned by U.S. Air Force and RAF until operational date when RAF will take over the station station.

Amery and warning signals will be available simultaneously to operational

control in the U. K., the United States and numerous allied command Europe. Work is expected to start soon.

Performance reaction to the station was said.

Pack for Orbital Mechanic Studied

Dallas, Tex.—Design study contract award of \$55,000 for a small self-maintaining back-pack propulsion station that would enable orbital mechanics to maneuver about in space, stabilize their vehicle while they are working on payload, to set in to help to maneuver vehicle assembly into position, has been awarded. Chance-Vought Corp.'s Astronaut Division in the USAF Astronautical Systems Division, Wright Patterson AFB, Ohio.

Design of the "Spacepack," as it is termed by Chance-Vought, will permit attachment to control rail pressure tanks on expendable rapid rate burning switch-controlled manipulation arm. For stabilizing the arm, Vought is studying manual and automatic rotation with controls provided by gyroscopes, inertia wheels and gas jets. In tests of propulsion there are controlling gyroscope and solid propellant jets, in addition to the possibility of a dual purpose system with one using oxygen for propulsion and fueling.

Chance-Vought engineers in next year expect to design a small and plastic backpack of a space backpack.

Ideas you can use from

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POSITIVE ION PROTECTION: New Electrical Propulsion De-ionizer available and qualified for high vacuum exposure. Complete unit weighs only 10 pounds. Electrical heating always reliable, eliminates frequent servicing required with liquid systems.



FOOT-THIGHT MANIPULATOR: Special Servicer* hand fingers, with rollers "top" finger and hand inside arm, makes a full-right and Servicer is arranged for lifting, grasping, grasping, releasing, and controlling objects by one man from one side of the work.



HAZARDOUS PRESSURE INJECTION: High pressure injection, 100,000 psi, can be indicated with the eye, sensitive device. Control is closed by a ballcock at pressure, in range of 250 to 500 psi.

For more information check your BFGoodrich Aerospace Representatives, at 11111 Southern Boulevard, a division of The B.F. Goodrich Company, Dept. 111-11, Akron, Ohio.



RUNWAY CLEAR...AT FORTY FATHOMS

Just as runway lights establish the boundaries of a landing strip at night, and the pilot relies on electronic eyes to see through clouds and darkness, submarines can be fully oriented to the sea depths of the sea by a continuous set of signals. Norden's contact analog display in the submarine's control room reveals on a single screen every key parameter: pitch, roll, heading, surface and bottom positions. This sophisticated system, utilizing advanced television and computer techniques, was developed for the Navy's Bureau of Ships. From concept to hardware in less than 18 months. With several modifications, the display is applicable to aircraft.

This is just one of several important programs at Norden (involving advanced television, radar, digital computing, and digital control systems). The contact analog display, pointing out the runway beneath the sea, demonstrates Norden's primary mission, EXTENDING MAN'S CAPABILITIES.

division of UNITED AIRCRAFT CORPORATION

NORWALK, CONNECTICUT



Bombardier heavy intercontinental bomber, escorted by two F-100 Super Sabres in T-28B aircraft (AFW July 17, p. 26) for an estimated Mark 38 cruise speed capability and Mark 14 dash capability. See pp. 72, 73 for additional photos.

Bomber Shows Progress in Russian Design Capabilities



Bombardier's engine produces an estimated 31,800-45,000 lb thrust. Inboard engine is equipped with afterburner, according to large diameter tailpipes. Flaps are constant chord, slotted constant geometry.

Almost all global strategists are enthused about

systems using Sperry electronic tubes

SPERRY

ELECTRONIC
TUBE
DIVISION

SPERRY RAND CORPORATION
SARASOTA, FLA.
GREAT NECK, N. Y.





Soviet Bomber heavy bomber can also have capability as an attack leader for releasing several Bambi bombers (AW July 24 p. 28; July 17, p. 26). Flying on belly ahead of the lead can be housing the base. Optical plots, possibly for laser operation, is visible at the end of the fuselage (see bottom photo, p. 73). Heavy looking air engine at the top of the modified 41 deg swept delta wing now in addition is housing the rocket engine leading gear. This bicycle gear is housed line and all of the wing, and the

increased section is longer giving Bomber a more high altitude on the ground. A 40 ft bomb bay is fitted between the gas housings and two wings in side are visible on the fuselage near the wing end at this point. Wing support strut is on the order of 2 ft. Engine nacelle diameter is estimated at 5 ft. Aviation Week drawing, published Day 1, 1955 (p. 30) and based on early information shows many similarities to Bomber (see p. 73). Bomber is painted light, possibly with anti-reflection paint on body, nacelle undercarriage





midair round-up for thirsty fighters



A-1/APN-101 (modified) Bendix-Pacific Beacon

Fighters equipped with Bendix-Pacific radar beacons can rendezvous with jet tankers for refueling—in any weather with pin-point accuracy. These beacons are used in conjunction with equipment already installed in the jet tankers.

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More Design Details Shown of Mi-6, Crane at Tushino

View from below of the Russian Mi-6 twin-turbine helicopter, carrying what the Russians said was the Vostok space capsule shows only wings which partially obscure the rotor during forward flight. Aft section of the capsule is of smaller diameter than the forward section. Retro-rockets are contained in cone in housing at the stern (AW July 17, p. 38). Flying near (right and below), derived from the Mi-6, appears to have a larger fuselage and a larger rotor system. Proportion on the left at the stern is probably a tail-topping interpretation for a cargo handler crew member. Fuel tanks are mounted externally on the fuselage in line with the main rotor. Fuselage shows considerable modification from the Mi-6 and has 12 instead of 30 cockpit side windows. Landing gear of the same apparent submodel as Wotro observed.





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Supersonic Transport Progress Is Reported

Washington — Federal Aviation Agency, Department of Defense and National Aeronautics and Space Administration results included in a joint review of U.S. supersonic transport progress that some basic technical problems assigned for both transonic turbulence and high-lift-rate error.

Even errors should be brought to bear on the same basic problems reported. It also declared that at least one manufacturer submitting technical data to FAA believes that the supersonic transport may be restricted to flight over unpopulated geographical areas.

Estimated costs for advanced development forwarded to FAA by industry range from \$75 million which includes the construction of two experimental prototype aircraft to \$140 million, which includes construction of two prototypes plus one "pilotless test" aircraft.

Engine development costs ranged from \$100 million to \$150 million depending on the approach taken by the manufacturer.

Most manufacturers agreed that the Western aircraft market for supersonic transports in the 1960-1970 period could produce of 100 to 150 aircraft. However, now, estimates range as high as 450 aircraft and one as low as 75. The production aircraft cost estimates varied from \$12.6 million to \$20 million per seat.

Old Tu-104 Engines Used in Mining Work

Moscow—Jet engines from Russian Tu-104 transports are being tried out as high-speed earth movers at Soviet open-pit mines. After they have air validated the machines flying service like allowed by Aeroflot.

Engines of P. Degtyarev and S. M. Voronovskiy have developed a method of increasing a speed jet engine, to a fixed central platform and attaching a steel pipe 25 ft. long and 1.64 ft. in diameter of the barrel. Kerosene and rock removed by an excavator are fed into the barrel from a burner above.

The engine's exhaust stream reports with loads pieces of earth and rock up to eight inches in size, a distance of 200 meters (656 ft.) in an endless valley.

According to the Russians, the new clear open path, built pass with a motor excavator. Along side of a light concrete, the metal looks like a jet. It weighs 100 tons less and costs about half as much. Most importantly, its maintenance does not require any new production capacity.



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MARQUARDT MULTI-CHANNEL MEMORY SYSTEM

allows realistic simulation of longer range and lower altitude tactical training missions

Based on a major breakthrough in information storage, Marquardt's new bomber/navigator radar training system provides outstanding simulation channel capacities. The flexibility and capacity of the Multi-Channel Memory—a high density storage medium—make possible realistic simulation systems capable of meeting the increasing speed, range, and altitude requirements of aerospace technology.

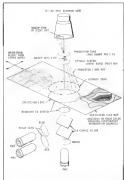
The Multi-Channel Memory uses a three color film transparency in which terrain, simulation and radar reflectivity data are stored on a micro-scale ratio of three million to one, or better. A highly detailed terrain map representing a land mass area 5,000 miles by 5,000 miles can be permanently stored on a slide only 48 inches by 12 inches. Because the map transparency is flat and terrain elevations are reproduced electro-optically, there are no physical limitations to its use. The system is particularly well suited for very low altitude simulation.

Information in the Multi-Channel Memory System is coded as varying densities of the three colors of the film transparency. During operation the transparent map is scanned by a flying spot scanner. After passing through the film the light is separated into various shades by three red mirrors and converted to electronic signals by photomultiplier tubes. The light intensity is each changed in dependent view, the absorption of the corresponding color dye in the film. The signals are then processed by a high speed computer and displayed on the face of the FP (plus-position-indicator) radar display.

Because of its flexibility and large storage capacity, the Multi-Channel Memory System has application to mobile and space training problems, information storage and retrieval, automatic language translation, advanced command and control systems, and similar computer uses.

The bomber/navigator training system mentioned above, and now being developed for the Air Force, is the result of more than ten years of experience in the development and manufacture of trainers and simulators. Marquardt has successfully produced, installed and maintained simulators on land and at sea, including land and navigation trainers, ground radar trainers, AEW/CIC trainers, special purpose trainers, and ground control intercept trainers. For information concerning Marquardt's training and simulation systems, expedition contact William Lord, Program Director, The Marquardt Corporation, Pomona, California.

Scientists and engineers experienced in the fields of simulation and training systems are invited to investigate exceptional career opportunities with The Marquardt Corporation. All qualified applicants will receive consideration regardless of race, creed, color, or national origin.



DATA EXTRACTION FROM COLOR TRANSPARENCY

The principle of land mass simulation storage and recall is shown above. Terrain simulation and radar reflectivity are coded as varying densities of the three colors of a color film transparency. As the light source scans (scans) across radar scan, signals are generated by the photomultiplier to provide information necessary to simulate a radar presentation.

★ MULTI-CHANNEL MEMORY UNIT

Shown on this opposite page is the heart of the Multi-Channel Memory System—a three color film transparency. Each color provides a permanent and separate information channel in perfect register at any point so matter how large the map.



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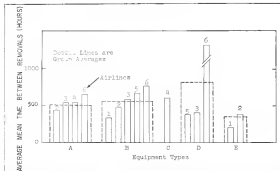
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THREE-YEAR airline avionics reliability, comparing three types of navigation receivers and two types of communication receivers installed by airlines, reveals greater variation in reliability among individual airlines than between different types of equipment because of individual operational and maintenance policies. Program revealed that communication sets had fewer catastrophic failures than navigation receivers, but were removed much more frequently because performance was more difficult for pilots to evaluate in flight. Study, conducted by Avion Research Corp., points up potential problems for instrumented equipment.

Avion Surveys Airline Avionics Reliability

By Philip J. Klein

Washington—Results of a three-year survey of airline avionics equipment reliability provide valuable guidelines for avionics equipment designers, this study indicates, and several operators, including the airline industry. Most of the conclusions also are important to designers of instrumented avionics equipment.

In the widely controlled three-year program, records of all reported malfunctions and their causes were obtained for three different types of VOR, navigation receivers and two types of VHF communication receivers as represented by six different airlines in the U.S. and Canada. The program and subsequent data analysis were conducted by Avion Research Corp.

Additionally, the equipment and various tubes produced by six different manufacturers, distributed among the different equipment makers and airlines. Although the original objective was to determine what equipment had been selected to take reliability more seriously, such was made in 1967-1974, the program produced data of some widespread interest.

There are some of the more significant findings, as revealed in an Avion Research Corp. report based on an assumed total of nine, then one-half million equipment operating hours, and more than 10 million tube operating hours:

- Most trouble between receivers due to spectrum compliance was 3,100 operating hours for VOR receivers, 539 for communication receivers. This corresponds to one removal every three months for navigation receivers and one every two months for communication receivers.
- Despite greater complexity of VOR receivers which has 27 tubes compared with only 17 tubes in the communication receivers, the navigation set exhibited much more the mean-time-between-repairs. This, coupled with other findings, indicates that it is much more difficult for a pilot to determine whether his communication receiver is operating properly than to determine whether his navigation receiver is operating properly.

This suggests that as

most designers might develop receivers by which the pilot could check the performance of his communication equipment in flight, at least qualitatively, to reduce necessary manual checks.

• Airlines lose thousands of man-hours of revenue when the performance of replacement tubes in equipment is not satisfactory. This suggests that as most designers might develop receivers by which the pilot could check the performance of his communication equipment in flight, at least qualitatively, to reduce necessary manual checks.

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most designers might develop receivers by which the pilot could check the performance of his communication equipment in flight, at least qualitatively, to reduce necessary manual checks.



Computer Handles Nine Problems Simultaneously

Stretch computer which can perform 30 billion multiplications in a 24-hr period is solid world's most powerful computer by International Business Machines Corp. which developed machine for the Atomic Energy Commission's Los Alamos Laboratory. Computer will be used in nuclear reactor and power reactor studies. Stretch computer can handle up to nine different problems simultaneously. IBM's new Machine's high-speed nucleus consists of six separate core units, capable of doing 95,000 words with 70-bit length and packing seven times of 2.1 microseconds. A super-speed motor provides 16 autonomous words time for frequency read data. Machine also has magnetic disk nucleus which can store 2,097,152 words with access time of one second. Machine can add nine transponders throughout.

station receives than with VOR receiver. It reports the most exact frequency within 10 of the desired. On this basis, it transmits before received such data, for each, as rate of communication receiver operating system, while navigation receiver assigned one each 10-sec. 18 words of reception.

• Greater variety in general data such as among individual engines than between different types of equipment. This indicates that maintenance practices are more in general nature, as indicated in engine schedule evaluation program for industry aviation equipment.

No Criticism Involved

The Anne Research Corp. findings are not intended in criticism either of flight crew or war zone maintenance personnel. The high number of communication equipment repairs is associated in the pilot's critical depend on, upon radio communications, in addition to the fact that there is an accident before industry in fact is for certain types of catastrophic failures in a VOR system. If the pilot calls a ground station and fails to receive a reply, he may think his equipment is out of work even if the real cause is improper adjustment of his own squelch.

control in routine completely outside his own equipment.

The percentage of communication receiver is used in the system considerably among different industries, ranging from a low of 11% to a high of 95%. The airline with the highest communication aircraft rate was one that flies short routes with frequent landings and its pilots make greatest use of communication equipment.

Removal Rates

Components	Removal Rate Per Million Operating Hours
Transmitters	
One Unit	8.5
Two/Three/More Units	2.9
Most Aircraft	
1 Unit	1.6
Two Units	0.51
Three Units	0.34
Four Units	0.17
Five Units	0.08
Six Units	0.31
Transmitters	0.96
Two/Three/More Units	0.17
Most Aircraft	0.29
* Low than other data	

So does Anne Research indicate the industry of airline maintenance men. When a pilot is returned to the shop with a report of communication performance, even though there may not be anything wrong with the equipment, the communication maintenance men take the opportunity to pick up equipment performance by replacing tubes which have deteriorated slightly, even though they still are within design limits, in an effort to prevent trouble removal in the near future.

Transistorized Equipment

However, Anne Research notes that "These findings should be carefully considered in view of the rapid development of transistorized equipment (for airline use). If the present maintenance practices were applied to transistorized equipment, the cost of maintenance would be unduly high." (The number of transistors in a transistorized communication receiver usually exceeds the number of tubes in a conventional equipment and individual transistors have been more costly than tubes.)

Although transistors do not deteriorate with use in the same way as tubes, some of their characteristics do change gradually with time, particularly when operated at high temperatures, Anne Research says.

This means that it is important for aviation equipment designers to know the gradual shape of performance characteristics when they design new equipment. Since communication equipment is rugged and highly sensitive, some of the deterioration in such equipment is later reaching a stable state which is considerably slower. To prevent frequent removal and replacement, during such an equipment's service life, it is designed to accommodate the early deterioration.

Because of the standards of present transmitter characteristics, Anne Research says, aviation equipment designers should not place greater reliance than solid transistorized equipment.

Because of the high percentage of tubes removed by airline maintenance personnel which were still good for significant further service, the airline industry is not a representative index of tube reliability, Anne Research points out.

One type of tube failure which causes catastrophic type equipment failure is an open-circuited heater which was found in 7% of the total tube removals. However, these occurred in only three out of the 15 tube types (containing heaters) employed in the test program. Types 6X4, 6Y4 and 6Q4. Of these, only the type 6Y4 failed to show marked improvement with respect to open-circuited heaters in later production quantities used in

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the test. The failure rate due to open failure modes was 9.5 per million tube operating hours.

The second test for internal tube short circuits was each 16 per million hours of tube operation and eight of the tube types operated for three years without a single internal short. Avco Research reports. Most of the shorts occurred in Types 5614 and 5725, third-high insulation-conductance products. The coil, double track, to lead because of internal shorts was the 4155, a cold study area type, and this was last been approved by its particular application.

Only 14% of the materials were due to glass or critical mechanical tube defects, and the rest was a 2% per million hours of tube operation.

Analysis of manufacturing trends in tubes before installation and after removal, at termination of the test, disclosed that those of tube insulation-conductance was determined by internal resistance and tube conductance. Avco Research says. Tube Types 5614 and 5619 were the most susceptible of the 11 tube types tested to surface contamination. Changes in transconductance due to tube conductance was last marked in high transconductance tube types in low transconductance types.

In general, significant variations in quality of tubes between different manufacturing lots did not appear in the test results because of the comparatively small number of tubes in the sample.

Although the workmanship and quality control of tubes are well in advance of present state of the art, Avco Research believes that the uniformity and long life stability of tubes could be improved by greater control of surface

three-axis and interface resistance. Even more important, however, is the position of higher-level, the largest single cause of major equipment failure. Avco Research says that this problem could be characterized, in greatly increased, by closer cooperation between tube manufacturers and avionics equipment designers.

Detailed designs of the accelerating test, prepared by E. J. Davis, are available as Report No. 411 for \$1.00 from Avco Research Corp., 1700 "K" St. N.W., Washington 6, D. C.

CalTech Calibrating 80-ft. Shock Tube

Passive, Caltech-California of shock waves in gas dynamics equivalent to atmospheric pressures at altitudes of 50 to 70 mi. will be studied in a tube 80 ft. long and 17 in. in diameter at California Institute of Technology, here.

The research, expected to help solve more aerodynamic problems in space and missile technology, will be supported by the National Aeronautics and Space Administration, which also funded construction of the \$300,000 tube, located in CalTech's Gasdynamics Aerodynamics Laboratory.

The tube, now in the calibration phase, has an initial test equivalent to that of an intermediate altitude cruise with 50,000 lb. of thrust. The vacuum shock wave, confined in the tube, has a force greater than a soccer ball and travels up to Mach 5.0.

The tube has seven stainless steel sections, is covered at each end with inch-thick steel plates. Walls are one-half inch thick. The interior is highly polished. Joint sections are mounted by a bolted flange, on which are a track supported from the laboratory ceiling so that they may be separated and reassembled.

Tube consists of a 12-ft-long driver and 68-ft-long test section, separated by a thin diaphragm diaphragm, which is the triggering mechanism.

As is prepared out of test section, test gas can be at pressures present of about 60 to 70 in. or as low as 10 in. at sea level atmosphere. Can-behavior, as nitrogen—can be pumped into driver up to 10 hours atmospheric pressure.

Pressure differential forces diaphragm to help into test section tube. Pressures are held until the diaphragm is torn, or the diaphragm's edge will blow. Once diaphragm is torn, high-speed wedges, releasing gas into vacuum and peeling diaphragm wedges against tube walls. Released pressure waves shock wave that moves the length of test section in one-half second of a second. Wave can continue back and forth the length of tube or can be dumped out

37700 FILTER CENTER 33217

Improved Solar Cell-New solar cell with improved response in blue region of visible spectrum now provides higher efficiency, or better power output per unit cell area, in space, according to Helicon Electronics Corp. Normally, solar cell power experience a 25% drop from rated efficiency when they are in space, the new cell now led out 18 or 15% below laboratory rating, the company says. This means that a solar cell need 12% efficient, single in fact convert solar to electrical energy at an efficiency as close as 10% in space. The improvement in performance made possible by a solar insulator which more closely approximates solar spectral characteristics in space than did the tungsten light which was the earlier standard.

New Kinet for Opt-Mass—Extremely narrow bandwidth and characteristics of optical mass (optical) suggest a variety of new aerospace applications, including precision alignment of parts in remote guidance systems. John G. Apsel reported at recent Perkin-Elmer Component Symposium Annual Director of research for the company's Instrument Division, predicted that the new device could use 10 to 20 different types of optical mass on the market, each with different characteristics.

Powerful Magnet Demonstrated—Continuous magnetic field of 125,000 gauss, roughly 500,000 times the strength of the earth's magnetic field, has been generated by the Massachusetts Institute of Technology under transverse magnetism. The magnet requires 135 gal. of water per minute for cooling and nearly 1.5 million watts of electric power. Available high power magnet under development by MIT is expected to produce 250,000 gauss. The magnet was built by High Voltage Technology Corp., Burlington, Mass. by MIT.

Thin Film Thermocouples—General Dynamics/Aeroflex is studying the conversion of thin film electrical energy in the use of thin film of thermocouple materials, rather than conventional thermocouples. Effect of device device materials are expected to yield converters with better efficiency and power densities than those made with thin film films which the company also is studying as part of thin film solar energy conversion research program.

Vibrationless Insulation—Cells in which no vibration is suffered are being made by Motorola for the Navy's Bureau of Ships. The micro steel elements are fabricated on integrated or non-integrated

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Available in 4, 6, 8, 12, 16, 20, 24, 30, 36, 48, 60, 72, 96, 120, 144, 168, 192, 216, 240, 264, 288, 312, 336, 360, 384, 408, 432, 456, 480, 504, 528, 552, 576, 600, 624, 648, 672, 696, 720, 744, 768, 792, 816, 840, 864, 888, 912, 936, 960, 984, 1008, 1032, 1056, 1080, 1104, 1128, 1152, 1176, 1200, 1224, 1248, 1272, 1296, 1320, 1344, 1368, 1392, 1416, 1440, 1464, 1488, 1512, 1536, 1560, 1584, 1608, 1632, 1656, 1680, 1704, 1728, 1752, 1776, 1800, 1824, 1848, 1872, 1896, 1920, 1944, 1968, 1992, 2016, 2040, 2064, 2088, 2112, 2136, 2160, 2184, 2208, 2232, 2256, 2280, 2304, 2328, 2352, 2376, 2400, 2424, 2448, 2472, 2496, 2520, 2544, 2568, 2592, 2616, 2640, 2664, 2688, 2712, 2736, 2760, 2784, 2808, 2832, 2856, 2880, 2904, 2928, 2952, 2976, 3000, 3024, 3048, 3072, 3096, 3120, 3144, 3168, 3192, 3216, 3240, 3264, 3288, 3312, 3336, 3360, 3384, 3408, 3432, 3456, 3480, 3504, 3528, 3552, 3576, 3600, 3624, 3648, 3672, 3696, 3720, 3744, 3768, 3792, 3816, 3840, 3864, 3888, 3912, 3936, 3960, 3984, 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Flight Propulsion NEWS



Convair 990 Hits Mach .97 During Speed Test Flight

SAN DIEGO, Calif.—Convair's 990 Coronado jet airliner recently logged speeds of Mach .97 during test flights over the Pacific.

This is the fastest true air speed ever attained by a commercial jet transport. Powered by four General Electric CJ 805-23 afterburner engines rated at 18,100 pounds thrust each, the 990 reached a topspeed of 874 mph at 32,800 ft.

The highest speed test flight was the 990 done at Mach .97 took an altitude of 32,800 ft. to 32,800 ft. The flight was made to demonstrate a "cushion" between the operating speed and the airplane's capability.

In earlier tests, the 990 jet achieved a series of demonstrations designed to increase its structural performance testing weight. Step 1 limited at Edwards Air Force Base to a weight of 102,000 pounds, 12,900 pounds heavier than the 193,000 pounds specified for the aircraft.

This performance will permit once aerodynamic range operations, making possible a longer series of short stage hauls without refueling.

A medium/long range jet capable of operating from 5,000-ft. runways, the 990 is designed to carry from 96 to 121 passengers. It is expected to cut transcontinental nonstop flight time by as much as forty-five minutes.

The 990's turbofan engines are equipped with the same 0.35 constant speed drives that have been proven in service aboard the turboprop 440.

General Electric Develops New Low-Cost, Lightweight Wooden Afterburner Crate

CINCINNATI, Ohio—Package design experts at General Electric's Large Jet Engine Department have developed a new low-cost wooden container for shipping J79 afterburners.

The new containers, which were developed in conjunction with the U.S. Air Force, weigh only one-eighth as much as metal containers previously used.

Designed in the Product Support Section of the Large Jet Engine Department, the container weighs only 237 pounds compared to 1,900 pounds for the metal container. Lightweight and durable, the wooden afterburner crate meets all Air Force and Navy requirements.

Appreciable savings in shipping and material costs have been effected as a result of the new containers, and need for long-term inventory to non-disposable special case is eliminated.



Convair 990 Coronado jet visible in highest test flight. CJ-805-23 powered aircraft (low at Mach .97, tested true speed over Atlantic by a jet transport).

FIRST McDONNELL F4H PHANTOM II'S ARRIVE AT OCEANA NAVAL AIR STATION

NAS OCEANA, Va.—Five McDonnell F4H "Phantom II's" were recently transferred here from NAS Miraflores, Calif., to join US Navy Fighter Squadron 201. VF-201 is the second USN unit to conduct training with the Mach 3 all-weather fighter.

At Miraflores, Fighter Squadron 123 has been training F-4H pilots since February. The Navy will continue F4H training at both air stations, with the first operational squadron of "Phantom II's" slated for fleet service in the near future.

Reports from pilots and maintenance personnel at Miraflores indicate that both aircraft and engine are performing extremely well.

The five fighters now assigned to Oceana are powered by two General Electric J79-2 turbojets, rated at the

16,850-pound thrust class Production F4H's now being delivered to the Navy are GE's J79-2, a more powerful version of the "J-7."

Power for the aircraft's parallel operating electrical system is provided by two G-E constant speed drives, each rated at 25-hp capacity.

Designed to become the Navy's standard Mach 3 carrier-based fighter, the McDonnell "Phantom II" has already demonstrated its operational capabilities by flying in an altitude over 40,000 feet and setting two world speed records. On September 4, 1960, an F4H-1 logged 1,016.76 mph as a 280-kilometer closed-course run, beating the former record by more than 400 mph. Three weeks later another F4H-1 set a new 193 kilometer world speed mark at 1,099.21 mph.



First of five J79-powered McDonnell F4H's arrives at NAS Oceana from the West Coast.

General Electric Studies Lift-fan Powered VTOL Craft for Retrieving Team

CINCINNATI, Ohio—A lift-fan powered VTOL transport which could become part of a "mother-daughter" team for retrieving valuable payloads is currently under study by the General Electric Company.

The new "daughter" VTOL aircraft would operate with a "mother" C-130 or equivalent, and provide global rescue of personnel and recovery of payloads up to 30,000 pounds.

The daughter aircraft would have a gross weight of 12,000 pounds and a maximum speed in excess of 450 knots. General Electric X355-5 lift fans will power the aircraft. The lift fans would be installed at an angle of 10 degrees from the vertical centerline of the daughter aircraft to reduce downwash in the pickup area.



Showing of C-47B aircraft towing "daughter" receiving a payload from ocean.

To begin a rescue mission, the two aircraft would take off separately. After reaching moderate altitude, the daughter aircraft would backstep with the mother and be towed to the rescue area.

The daughter team would detect, descend, retrieve the payload and fly back to the mother aircraft for re-stationing and return trip.

During return flight to the base the crew or personnel might be transferred to the mother aircraft through a pressurized hatch. Upon reaching the landing area, the daughter would again separate from the mother, and the two would make separate landings.

The "mother-daughter" method of accomplishing search and retrieval missions takes advantage of the VTOL and high speed capabilities of the lift-fan powered daughter, and the long-range abilities of the C-130 (mother). In addition, the "daughter" will operate above an up-draft, short-range retrieval aircraft.



Sikorsky HO4S-3 in flight at 155-3 as a Sikorsky helicopter world speed record.

T58* POWERED HSS-2 RECAPTURES HELICOPTER RECORD FROM RUSSIANS

WASHINGTON, D. C.—A new helicopter world speed record of 173.5 mph was established May 14 by a US Navy Sikorsky HSS-2 helicopter over a 100-kilometer (110 mile) straight course at Wadsworth Field, Conn.

Powered by two General Electric T58 gas turbine engines, the fast-paced HSS-2 joins the fast this year as a submarine hunter-killer.

The fastest speed previously flown by a helicopter was 107.09 mph by a Sikorsky HO4S-3, November 21, 1959 over a closed hundred kilometer (60 mile) course. On May 14 the Sikorsky HSS-2 reclaimed that record from the Soviet Union by flying a similar course at 174.00 mph. The new record is due to contribution by the Federal Aerospace Administration.

The HSS-2 is a key weapon in the nation's anti-submarine warfare defenses. Designed and developed as a weapon system with anti-submarine capability, the HSS-2 is the first Navy "copper shrike" to detect, identify, track, and destroy enemy submarines.

The HSS-2 has "round-the-clock" operational capability. Amphibious land, surface mobility, integral sensors and attack equipment and record breaking speed give it performance that far surpasses present piston-engine anti-submarine warfare helicopters.

The General Electric T58 powerplants, major contributors to this outstanding performance, each produce 1330 horsepower and weigh only 295 pounds. Operating at only one of its seven T58's the HSS-2, at normal 4,000 maximum weight, can continue to fly using the military 30-minute power rating.

The T58 also powers the Kaman HH-24, and Sikorsky-Verdel HH-61. The C158, and versions of the engine, powers the Sikorsky H-61 and H-62 and the Sikorsky-Verdel 107.

FOR FREE INFORMATION

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rete solenoids by combination of vacuum evaporation and electroplating techniques. The spools are about 10 mils thick. An end induction deposited on 170 mil-diameter spindles have powered inductances of 2 microhenrys. Qs of 62 at 60 mc.

• **Solar Cell Cores-Glass** even with thin film interference films various deposited on their surfaces are being made by Optical Coating Laboratories, Inc., to improve operation of solar cells in space. When tilted over solar cells, the blue and ultraviolet solar cell covers will reject solar radiation outside the 0.4 to 1.1 micron wavelength region usable in the energy conversion process. Cores will reduce unnecessary heating of the cell, prevent the cell from damage and erosion by micrometeoroids. Optical Coating Laboratories is located at 2759 Gelfen Ave., Santa Rosa, Calif.

• **Lightweight Daylight Star Tracker**—A 10th electronic star tracker capable of achieving pointing accuracies of better than 1/2 arc of arc with 40 in. focal-length optics has been developed by Lioscope Division of General Precision, Inc. Indicated weight does not include batteries (4 units are required), servo amplifiers and angle encoders. Tracker employs special photoemissive tube as a sensor, measures about 4 in. in diameter and 15 in. in length.

• **Signed on the Dotted Line**—More contract awards recently announced by aerospace manufacturers include:

• **General Precision, Torrington, N. Y.**, has received a contract from Martin Marietta for study of guidance system requirements for Space Logistics Mainstems and Rescue Vehicle (Remus), which Martin is studying under USAP contract.

• **Sylvania Electric Products, Applied Research Laboratory**, will study effects of the earth's magnetic field and its relationship to causes of violent electric storms, sea storms and solar flares, under \$45,000 contract from USAP. Cambridge Research Laboratories.

• **Collins Radio Co., Cedar Rapids, Iowa**, \$1.64 million Air Force contract for VHF communications systems to be used on C-141s and Hercules aircraft. General also reports \$103,626 add-on contract from Jet Propulsion Laboratory for reliability and maintenance engineering assistance at JPL's deep space instrumentation facility in Johannesburg, South Africa.

• **Westinghouse Electric, Aerospace Electrical Department, Lima, Ohio**, \$58,000 study contract from USAP's Aeronautical Systems Division. Do-ber for a 100-watt silicon power system for space vehicle use designed to provide minimum life of one year.

NEW AVIONIC PRODUCTS



• **Film resistors, Model EM 10**, a carbon film resistor enclosed in a molded dual phenolic jacket is available in resistance range from 10,000 to 100,000 ohms (1% tolerance), rated at watt at 70°C. The resistor meets requirements of MIL-R-10590C, measures 270 mils in length and 100 mils in diameter and has 15 in. axial leads of #26 AWG wire. Manufacturer: MEPCO, Inc., 37 Abbott Ave., Monmouth, N. J.



• **Backward wave oscillator, type BW-429A**, for operation in the 16 gc to 28.5 gc frequency range, designed as a voltage-tunable signal source for microwave receiver local oscillator applications, test equipment and signal generating equipment. Tube is 5 in. long, 14 in. in diameter and weighs 5 lb. including a gas-tight support which houses the beam. Minimum power output from the tube is 5 milliwatts. Price for a single tube is approximately \$1,000. Manufacturer: Sylvania Electric Products, Inc., 1100 Main St., Buffalo 8, N. Y.

• **Semiconductors, PAL-15 and PAL-1P series**, completely self-contained semiconductor microwave radio-frequency amplifiers deliver high level signals for telemetry, control or measurement to accuracy of 0.1%. Power requirement is 4 watt. Manufacturer: Pioneer Scientific Corp., Palo Alto, Calif.

• **Cryogenic measuring systems**, which include fast response germanium film sensors and special "cryostat" potentiometric modules, are available for low temperature (below and below zero) measuring applications. These modules are of three types—calibrated,



Convair uses DORSETT Telemetry Equipment

MACH 2-PLUS SPEEDS and service ceiling above 60,000 feet are just two in literally hundreds of radically new innovations Convair/Fort Worth engineers specified for the Air Force F-108... already holder of many world speed records!

Yet, such unique device was already a proven unit, from the J-79 jet engines to the bonded-sandwich wing panels. Despite such formidable demands, Convair flight-tested the first "Hustler" just 26 months from release of engineering drawings!

Test schedules for this unprecedented assembly of "new" components require unsurpassable accuracy in telemetry equipment. Dorsett, a major supplier of subcarrier oscillators to Convair/Fort Worth for over four years, filled (and continues to meet), the requirements for as many as 300 subcarrier oscillators per test plane! The Dorsett Model 0-3 is used in pre-assembled multiple unit banks. The Dorsett Model 0-25 incorporates voltage controlled oscillator is used for special test functions. Be sure to include DORSETT on your Vendor's list for telemetry systems and components, including Subcarrier Oscillators, Transmitters, Mixer-Amplifiers, Voltage Regulators, Power Supplies, Keys and System Packaging.



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VORTEX FACILITIES NAA-Columbus has one of the largest wind tunnel VORTEX design testing sections in the world (116 feet wide by 96 feet high). This is part of the extensive VORTEX facilities Columbus has used in the development of both lift-lift and take-wing aircraft which need no runway for take-off or landing.



COMPLETE DUTY NAA-Columbus is building the complete Army Redoubt-Roadrunner target missile system. This economical new missile will fly subsonic in supersonic maneuvers and will operate at altitudes up to 50,000 feet.



"RAYSTACK BELL" ANTENNA A 150-ft. antenna system, using a new concept that distributes tension evenly in great distances is readying, is being built by Columbus for USAF as Raystack Bell one. Boston, Mass.



ANTI-SUBMARINE WARFARE NAA-Columbus is at work on new applications of anti-submarine warfare to meet the threat of highly advanced submarines. Other research and development projects at Columbus include advanced battle field surveillance, and surface-to-air and surface-to-surface missile systems.



ACCIDENTAL AND UNDESIRABLE The system can be converted to standard d.c. according. Manufacturer: Texas Instruments Inc., P. O. Box 6827, Houston 2, Tex.



CHIF Harmonic Filter, Model 250, eliminates harmonics of 215 to 260 mc. telephony, transmitters in aircraft and ground applications. The 4-in. filter is designed in the RF output line for a personal light transmitter. Filter's pass band is zero to 120 mc., rejection less than 5 db below 260 mc., 10 db above 415 mc., more than 15 db below 260 mc., power rating a 15 watts. Priced at \$115 each in small quantities, the filter can be obtained from Radio Shack, Adams-Russell Co., Inc., 230 South St., Cambridge 42, Mass.



Vothel sensing element, Model 228711, a single axis, snap action, electrolytic unit which can drive torque motor directly without requiring amplifier is being added to a series of sub-miniature Vothel sensing elements. The "on-off" instrument concept is called, has tilt angle of 0.75 deg. (plus 10 cc. rotation) from full scale in one direction to full scale in the opposite direction, 35 v. differential net post voltage and 10 ma. rms current through either contact. Manufacturer: Knudsen Division, General Precision Inc., 1150 Melville Ave., Little Falls, N. J.



"FORGING MILITARY SPACEPOWER"

USAF SYSTEMS COMMAND ISSUE

SEPTEMBER 25, 1961

On September 25, AVIATION WEEK and Space Technology will publish one of the most important issues in its history . . . "FORGING MILITARY SPACEPOWER" — USAF SYSTEMS COMMAND ISSUE. For the first time, the complete story of the newly activated USAF Systems Command will be presented to the aerospace industry throughout the world.

The new Systems Command will serve as a single agency to control R&D and procurement of all aircraft, missile, atomic and space systems for the USAF from the idea stage through the time they are in the field ready for use. This concept of a single agency for both systems R&D and systems procurement will have penetrating impact on all aerospace industry companies selling hardware or

research services to the Air Force.

The Systems Command will control approximately \$15 billion in contracts and annually will award \$1-8 billion in new contracts making it the most important single source of aerospace industry business. Further evidence of the impact on industry are policy and procedure changes which can be expected in many areas such as technical approach, contract competition, proposals, cost estimating, management structure and subcontracting.

There are just a few of the important details to be covered in the Systems Command Issue, which will constitute a new handbook in doing business with the Air Force. Teams of AVIATION WEEK editors are now visiting the various bases of the Command for full, complete reports. Detailed edi-

torial coverage will be given to procurement, organization, plans and programs, policies, procedures and future technical activities.

AVIATION WEEK is privileged to present this edition to the industry covering our newest and vitally important Command. Prime contractors, subcontractors, suppliers and firms doing R&D work for the Air Force will be extremely interested in this new issue which will lay the groundwork for future contacts with the Command. It will supersede all previous editions on USAF research, development and procurement policies.

Your company is urged to participate by advertising its capabilities and facilities for the furtherance of the defense effort. Write, wire or call collect for space reservations.

Aviation Week
and Space Technology



A MCGRAW-HILL PUBLICATION

220 West 42nd Street, New York 36, N. Y.



Gyro Autopilot Needs No Electric Input

By Willem S. Reed

Los Angeles—Increasingly popular, simple gyro autopilot systems for aircraft up to light twin size are being marketed by Britton Industries, Inc., following five years of development, including two years of testing in the field.

Depending on version supplied by an engine-driven pump, or a specially designed version, the Britton flight control provides precise heading hold, and wings level attitude control without an electrical or electronic input or output.

The autopilot flows by the Autovac Wren, pilot is a Piper Comanche 21B owned by Britton President Karl Fyfevald, M.D. was found to hold heading with fine accuracy. Control approached in smoothness that rivaled by a human pilot. Unlike some automatic flight devices, the Britton unit applies smoothly, proportional force to the controls rather than jerky motions.

Setting descent of the entire is a gyro similar to that found in a turn and slip indicator and possessing the same

reliability inherent in that instrument, Fyfevald contends. The gyro, utilizing the principles of inertial guidance, is inclined at an angle varying from 35 to 40 deg. to the longitudinal axis of the aircraft. Exact angle of inclination depends on the type of aircraft in which the installation is made. By turning the control magnetism, variations in both yaw and roll are sensed by the angle gyro. The complete sensing device is mounted in the control head which contains a universal mounting adapter for the instrument panel.

Control actuation is accomplished by pneumatic cylinders and piston combinations which by the nature of their function do not have to be constructed with any great precision. Failure in the B-1 between piston and cylinder is about 1 in. with the supercooled turbine forming a seal.

Again depending on the installation, separate actuators are supplied for lateral and directional control or a single proportional actuator can be used where there is a twin between rudder and aileron. Short lengths of cable connect the actuators to the control cables. With the system turned off,



SUPRANCE ELEMENT of the two-axis Britton parameter autopilot is mounted on the instrument panel. Note the angle of the gyro housing which enables the angle gyro to sense movement in both the lateral and directional axes. Full deflection of the turn knob produces a 2 min. turn.

the controlling valves are shut, and make no landing on the controls for manual operation. Slack is required when vacuum is applied to the system.

No panic switch is necessary for the control which for momentary of the system in the event of manual flight. Proper is required on the instrument unless the sensing gyro goes a constant. Therefore, effects of the autopilot are hardly perceptible when the system can be recognized by the pilot. During Autovac Wren's flight in the Comanche, a heading was made with the system on and no difficulty was noted in handling qualities.

Another feature noticeable not found in light aircraft autopilots is the usefulness of the system in such a situation of the unit can be decommissioned in such as it was experienced as flying over the mountains along the Pacific Coast during the demonstration. Because of the "softness" of control inputs, overruling of the control system and structure was not necessary. Nor is there any loadness of the unit to stall since there are no bank or roll limits to the degree of effectiveness of the gyro. It can be used to recover from steep banks, spiral descents or other critical positions.

The Britton unit is completely accurate from the gyro horizon and directional gyro of the aircraft's flight instruments. An inexpensive gyro instrument does not make an acceptable



Swedish Aircraft Features Sandwich Construction

At Malmö Flygfabriks AB demonstrated a prototype of a Swedish four-engine high-wing light aircraft for civil and military use designated MPT10 Viggo. Developed in collaboration with Sankt Åmreth Co., the Viggo features a sandwich construction of two bearing shells of aluminum alloy with honeycomb structural spacers for the fuselage, wings and control surfaces as well as a glass fiber reinforced plastic landing gear. The Viggo has a maximum speed of 150 mph and a rate of climb of 300 ft/min.

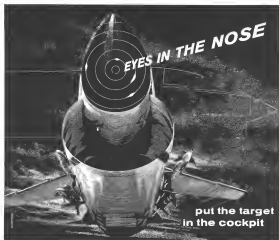

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TAPCO is a major facility offering research design development and production of systems, subsystems and components to the missile, aircraft, ordnance, marine, electronic and aerospace industries. Proof of the quality and advanced nature of TAPCO capabilities lies within such prominent programs as: SMAP, Sonotower, Pershing, Bomarc, Taurus, Taurus, Mendenhall, F105, B-58, B-70, X-15, Mercury, Dytic, Star. **ADVANCED ENERGY CONVERSION SYSTEMS:** Closed cycle Stirling turboelectric (jet, gas, mercury, potassium organic), turbine APUs, a MWID, thermocouple, fuel cell. Energy sources employed include solar, nuclear reactor, stored thermal energy, chemical and cryogenic fuels. **ADVANCED PROPULSION:** Arc ion rockets, plasma accelerators, air propelled fuel systems, reaction flight control systems, attitude control systems, vector nozzles, vernier rockets. **ADVANCED ELECTRIC POWER GENERATION AND CONTROL:** Brushless alternators and static inverter systems operating from any energy source and at voltages to 1000V. Analog/digital servo subsystems. Static standby power supplies for uninterrupted transfer of power. **INTEGRATED ENVIRONMENTAL CONTROL:** Space vehicle temperature control; space vehicle atmosphere control, closed cycle oxygen regeneration. **MISSILE LAUNCH AND SUPPORT:** Mobile air portable transporter/storator/launcher vehicles, integrated handling and control systems; special airborne and ground test equipment. **UNDERSEA SYSTEMS:** Propulsion and control, submarine detection systems, drag reduction; hydrogen generation; special hydrodynamic studies. **FLUID SYSTEMS:** Aircraft engine drives, booster and after burner fuel pumps; flow control and relief valves; linear and rotary hydraulic actuators. Cryogenic fluid systems, hot gas servo systems. **SPECIAL INSTRUMENT PRODUCTS:** Weather and gas loss calibrators, precision magnetic storage devices, signal-conditioning subsystems. **IN VIDEO TELEMETRY SYSTEMS:** Broadband transmitters and receivers, multiplexing, subcarrier channels, automatic servo controlled tracking. **MATERIALS TECHNOLOGY:** Develop extrusion, forging, welding and coating processes for superalloys and refractory metals. Study liquid metal corrosion. Perform applied research and application engineering for plastics, composites, high-strength metals and refractory metals for hot gas service, rocket engine components, high temperature motors and unusual power generating equipment.



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[illegible]

Shifts. *Fireworks Industry Breakdown* shows 1,000 limited liability trusts in 1994, up from 750 in 1993. Of the 1,000 trusts, 100 were established in 1994, and 900 were established in 1993. The industry's total assets were \$1.1 billion in 1994, up from \$1.0 billion in 1993. The industry's total liabilities were \$1.1 billion in 1994, up from \$1.0 billion in 1993. The industry's total equity was \$1.1 billion in 1994, up from \$1.0 billion in 1993. The industry's total assets were \$1.1 billion in 1994, up from \$1.0 billion in 1993. The industry's total liabilities were \$1.1 billion in 1994, up from \$1.0 billion in 1993. The industry's total equity was \$1.1 billion in 1994, up from \$1.0 billion in 1993.

autopilot as in the case where interference from the autopilot operation is picked off other arms.

Precession of the gyre in the grid was not a vertically all and the instrument has been into it a precise 2 mm. tube. Several of these were used in the Comanche with the two coming out within one or two degrees of 180 deg. in all cases.

Britann recently secured a "license" from Beech Aircraft Corp. for the manufacture of British computers which will be installed by Beech and bear a Beech trademark on the control panel. The system was developed and patented by Nick Clarke, now vice president of Britann for research and development.

Soon to be marketed will be a hand using select system for the ungrainist and a patch was used which will not require any inputs for operation. Fradenfeld revealed Supplemental type certificates for the latter units as well as the two unit test stands, on the market have been obtained from the Federal Aviation Agency, Fradenfeld says.

Typical graphs of the asymptotic regret

PRIVATE LINES

National Aeronautical Corp., Fort Worth, Pa. is making delivery of its Navo UDI-2 Distance Measuring Equipment (DME) for private and business aircraft to regional airlines. Units have also been delivered to Federal Aviation Agency for test and evaluation purposes. Each unit has a range of up to 100 naut. mi., weighs 14 lb. and sells for \$2,720.

Lycoming's TVO-615 turbo-supercharged helicopter engine, designed to power the Bell 475-III helicopter, has been certified by Federal Aviation Agency. The new engine, which features an Allison T-110 turbo-charger, has a takeoff rating of 265 hp, and maintains this rating up to 11,000 ft with a maximum continuous rating of 270 hp up to 16,000 ft.

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BARBER-COLMAN COMPANY

Journal of the Philosophy of Education Society of Great Britain
 Vol. 31, 2000, No. 3, 343-354

North American's 1961 Sales Total May Set Record, Atwood Says

New York—North American Aviation's sales for its fiscal 1961 year will total \$1.2 billion to \$1.3 billion, possibly the highest in the company's history and may reach that volume again during 1962, J. L. Atwood, NAA president, said here today.

Sales of this order should bring company earnings for the year to \$3.70 to \$3.90 per share. Indications are that North American's earnings already have reached \$2.25 per share, during the first three quarters of the present fiscal year and high fourth quarter earnings are expected. The company earned \$2.57 per share during all of fiscal 1960.

Cause for order backlog totals now, the 1958 million, the highest since 1957, and proposals under negotiation total \$987 million, including a proposed backlog of \$1.9 billion, Atwood told the New York Society of Securities Analysts. Of this total, he noted, 47% is represented by electronic and electro-optical programs.

North American's capital expendi-

tures in 1961 will total an estimated \$28 million with expenditures estimated at \$15.5 million. Atwood said capital expenditures should drop somewhat in 1962 and that North American is not planning any equity financing program in the near future.

North American's 1960 total sales of approximately \$984 million rank third among the company's six operating divisions in that order.

• **Aircraft International Division**, commercial nuclear reactors, aviation engine and engine associated reactor equipment and Ship programs, \$49 million.

• **Automotive Division**, electronic and electrochemical equipment for Minuteman, Polaris submarine, GAM-77, A-10, F-104 and F-105, \$345 million. The Minuteman program accounts in the company's largest in terms of total estimated value and contribution, over the next three years approximately 40% of Autotech's business.

• **Columbus Division**, A-1J Redhead/

Redhead target missile and torpedoes, \$132 million. The A-1J attack aircraft program is North American's second largest single program.

• **Los Angeles Division**, B-36, T-39 and X-15 projects, \$260 million. The B-36 program, design recent orders and the company's fourth largest program.

• **Rockledge Division**, Atlas, Saturn Titan and F-105, \$176 million.

• **Space and Information Systems Division**, GAM-77 and space and weapons systems research, \$82 million. The GAM-77 Hound Dog missile program is the company's third largest in total estimated value.

Concerning the diversification apparent in North American's and the entire industry, Atwood said what once could be called the aircraft industry has in recent years, become something so diversified that it virtually defies description. Further, he said, this diversity is in the field of such technical changes that generalists about it so heavily over-rely.

The more aerospace he said, does not encompass all of the large fields, such as submarine and electronic, reference from industries in which individual com-

panies inevitably will be involved. Despite this wide diversification, the companies in the industry are generally referred to as "aerotech." While most members understand that a term of convenience, Atwood said, the general public still tends to identify the companies with one another in a way he termed "aerotech."

If one company should experience some difficulty in one of its diverse fields he said, the result may be that, prior fluctuation of other so-called "aerotech" which may not even be involved in the same sector.

Atwood said while the increased degree to which aerotech process has come to supplement industrial might as a source of turbulent power. Cost time increases slowing research development and testing, an diversified from production, accounted for approximately 77% of North American's fiscal 1960 sales and should account for approximately 85% of the company's sales in fiscal 1962.

Despite diversification, Atwood added, the future of manned aircraft should not be discounted. Renewed emphasis on preparation for limited warfare has generated requirements for new fighters and V-STOL aircraft.

Rolls Reports 1960 R & D Expenditures

London—Rolls-Royce, Ltd. last year spent \$214 million on research and development, mostly on aircraft engines. Similar expenditures will amount to a high level this year.

Lord Kintore, Rolls-Royce board chairman, in referring to research and development work in his report to stockholders, said "I have every hope that in 1961 we will see a better return on our capital expenditures than in the past few years."

A considerable amount of this funds has been spent on such engines as the Spey for the BAC 111 medium range jet transport, and the de Havilland Trident, a more powerful version of the Conquest for the Vickers VC 10 long range jet transport and also on lightweight central jet engines based on the J44, 121 proposed for an SVOL version of the Short Belfast fighter.

Rolls-Royce profits of \$8.5 million, up \$1 million from the previous year, were offset by research and development costs and "exceptional expenses arising from technical troubles with the Trent engine," which experienced metallurgical problems in the compressor wheel, Lord Kintore said.

Company sales as of Dec. 31, which include subscription, diesel engines and industrial turbines, totaled \$305.9 million, up about \$32 million from the previous year.

New Offerings

Aerospace Manufacturing Corp., Modesto, Calif. development and production of defense products and the design and installation of command and industrial environmental control systems. Offering is 160,711 shares of common stock. 1962 sales to be offered on the basis of 15% share for each share of the capital stock of Flight Refueling, Inc. and an additional 25-35% share on the basis of 15% share for each \$100 principal amount of Flight's 6% subordinated convertible notes due 1963. Flight Refueling produces a probe and dogleg system of aerial refueling.

Polymatrix Research, Inc., Rockville, Md. (formerly Aero-Tek and Aero-Mat), development in research and development, engineering, production and sale of certain electronic and electro-mechanical devices and test equipment products suitable equipment and components and aircraft engine equipment, including, offering a 150,000 common shares for public sale in the company, and 12,500 outstanding common shares for the present holders' shares. The offering of common shares will be made on an all or none basis, public offering price and underwriting terms to be supplied by underwriter. Proceeds from the company's sale will be used to expand manufacturing facilities and equip the building with additional necessary shop facilities, to expand sales and engineering force and to finance a research and development program to give a \$19,000 bank note, to raise \$15,000 of 6% convertible debentures due March 31, 1962, to pay \$78,000 of balances due on certain other outstanding obligations, the balance to make possible acquisition financing of present contracts and to make it possible to negotiate future contracts for a showing of additional financial performance.

Stratulus, Inc., Fort Worth, Tex., engaged in the design, manufacture and sale of hydrostatic and pneumatic type loss, hose fittings and hose assemblies (suspending both the detachable, reusable and permanently attached end fittings, seal tubing and quick disconnect couplings, mechanical locks, limited tube assemblies and self locking nuts). The company provides research and development and design engineering, its service and sales are primarily in the aircraft, naval and missile industries, and to other industries. Offering is 100,000 shares of common stock for public sale, public offering price and underwriting terms to be supplied by underwriter. Proceeds will be used for the payment of all existing equipment notes and bank indebtedness, and the balance will be added to general funds.



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PROBLEMATICAL RECREATIONS 78

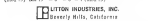


Assume the universe is a billion billion light years in diameter and is pecked solidly with matter weighing a billion billion tons per cubic inch and each grain of this matter contains a billion billion stars. Also, every second during the past billion billion years a billion billion similar universes were created. Without using any symbols and restricting yourself to a total of three digits write a number that far exceeds the total sums of all these universes.

—Cordwaine

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ANSWER TO LAST WEEK'S PROBLEM: No. From the multiplication table modulo 13 one sees that $3X \equiv 0 \pmod{13}$ if and only if $X \equiv 0, 1, 3, \text{ or } 9 \pmod{13}$. Thus $3X \equiv 9 \pmod{13}$ can be congruent to anything except 7 (mod 13). But $18X \equiv 9 \pmod{13} \pmod{13}$.





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WHO'S WHERE

(Continued from page 21)

Changes

Robert E. Aring, executive engineer, World Division of The Boeing Co., Tacoma, Pa.

J. W. Keating, manager, Radar Area, Boeing Division of Aeronautics Corp., 3601 Redwood Ave., Redwood City, Calif.

Vin M. 180, manager, Washington, D. C. office of Callahan Bros. Inc., according to Ray Field who has been transferred to the Los Angeles office.

Ben S. Minkow, Jr., acting manager of the new Federal Specialty Design Division, General Electric Co., Defense Systems Department, Syracuse, N. Y.

James N. Sawyer, resident scientist, American Airlines, Inc.

Edw. A. Cahn, president of the Aeronautics Division, General Electric Co.

Dr. John N. Dwyer, director, Research Center of Minneapolis-Hennepin Regional Co., Minneapolis, Minn., according to Guy W. Brannigan, area general manager of the Minneapolis Division.

Joseph Rabe, chief mechanical engineer, Motorola, Valley Forge Division, Defense Systems Center, Springfield, Ill.

R. H. Nelson, chairman, manufacturing manager, The Boeing Co., San Diego Division, San Diego, Calif., and R. W. Lewis, wing director of a new electronics packaging group, Charles Deere, San Diego, Calif.

Tom F. Wadsworth, chief of the newly created Space Development Systems Section, Space Systems Division, Jet Propulsion Laboratory, California Institute of Technology, Pasadena, Calif.

Alfred G. Treadwell, assistant section chief of Research and Development, Space Systems Division.

Paul C. Malone, general manager, Hamilton Electric Corp., Pacific Division, Los Angeles, Calif.

John K. Kennedy, manager of the newly formed Systems Section and Chairman, Panel on Systems, General Electric Co., Defense Systems Department, Syracuse, N. Y.

Keith E. Smith, program department manager, Space Research, Inc., San Francisco, Calif.

John W. Johnson, director of public relations and education, Long-Term Research, Inc., Dallas, Tex., and Luther S. Smith, assistant to the head chairman.

William R. Butler, general manager, Systems Division, Polaroid Chemicals Corp., with offices in Haverhill, Mass.

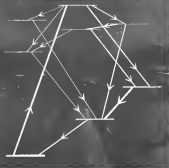
William M. Shedd, chief engineer, General Electric Equipment Department, Hamilton Division, Division of United Aircraft Corp., Garden City, Conn., and Charles R. Butler, chief engineer, Electronics Department.

Vincent P. Baggard, manager, Los Angeles, Defense Electronics Products, Radio Corp. of America, Washington, D. C.

Carl H. Gottwald, director of engineering, Radio Electronics, Radio Corporation of America, New York, N. Y.

Ray E. Leffing, general manager, Armstrong, Williams Corp., Northridge, Calif., England.

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experts are invited from various scientific sections of providing their own research efforts in the following (or related) areas of electro-physics. Such research may be at theoretical and/or experimental levels.

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BASIC STUDIES of radiation damage in crystals such as β^+ emitters.

BASIC STUDIES of pumping by means of optical or microwave stimulation, cathodoluminescence and photoelectric emission from a vacuum cavity, and emission of materials under vacuum (osmium vapor, etc.) or solid state, rates of emission and question of excited states.

Because of the advanced nature of these investigations, they should appeal to mature, experienced scientists in the electronics equipment field. Such men will not be limited by rigid boundaries. They will be given freedom to discuss and pursue their own lines of research, providing this research is within the scope of corporate interest.

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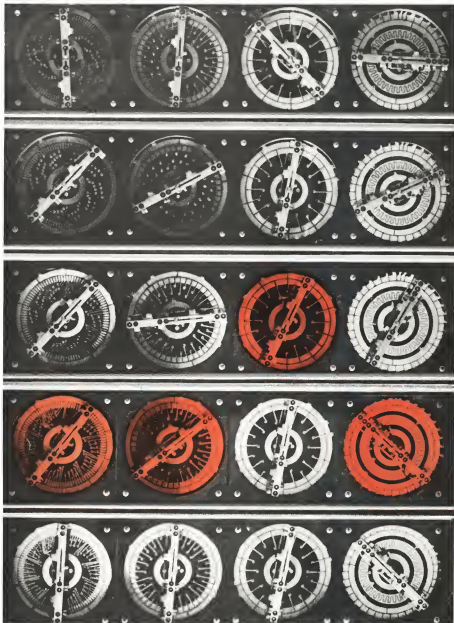
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